13 | COMPARING QUANTITIES

RATIO

13.1 INTRODUCTION (RATIO)

A ratio is a comparison of two numbers (quantities) by division. The ratio of a to b is written as a : b or $\dfrac{a}{b}$.

In the ratio a : b, a and b are called terms of the ratio. 'a' is the antecedent and 'b' is the consequent. A ratio is a number, so to find the ratio of two quantities they must be expressed in the same units.
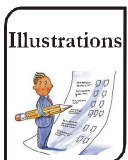

Illustrations

Illustration 1

   Find the (i) ratio of ₹20 to ₹80   (ii) ratio of 3 km to 600m

Solution.

(i)   20 : 80 or 1 : 4

(ii)   3000m : 600m or 3000 : 600 or 5 : 1

13.1.1 Properties of Ratios

(a)   In a ratio, two quantities are compared. So, the quantities must be of the same kind. i.e., they must be expressed in the same units.

(b)   The value of a ratio remains unaltered if the given ratio is multiplied or divided by the same non-zero quantity. If a, b and m are non-zero real numbers then a : b = ma : mb and a : b = a/m : b/m

13.1.2 Dividing a Given Number in the Given Ratio

Let 'X' be the given number, the given ratio is $x_1 : x_2$. Now, x is to be divided in the ratio $x_1 : x_2$.

X is to be divided into two parts such that

Value of first part : Value of second part = $x_1 : x_2$

Therefore

$$\text{First part} = \left(\frac{x_1}{x_1 + x_2} \right) \times X$$

$$\text{Second part} = \left(\frac{x_2}{x_1 + x_2} \right) \times X$$

Illustration 2

Two numbers are in the ratio 4 : 5. If the sum of the number is 63, then find the numbers.

Solution

Here 63 is to be divided in the ratio 4 : 5.

∴   First part (number) = $\dfrac{4}{4+5} \times 63 = \dfrac{4}{9} \times 63 = 28$

∴   Second part (number) = $\dfrac{5}{4+5} \times 63 = \dfrac{5}{9} \times 63 = 35$

or   second part = 63 – 28 = 35.

13.1.3 Certain Types of Ratios

(a)   **Compounded Ratio :** The compounded ratio of a : b and c : d is ac : bd.

(b)   **Duplicate Ratio :** Duplicate ratio of a : b is $a^2 : b^2$.

(c)   **Triplicate Ratio :** The triplicate ratio of a : b is $a^3 : b^3$.

(d)   **Sub-duplicate Ratio :** The sub-duplicate ratio of a : b is $\sqrt{a} : \sqrt{b}$.

(e)   **Sub-triplicate Ratio :** The sub-triplicate ratio of a : b is $\sqrt[3]{a} : \sqrt[3]{b}$.

(f)   **Inverse Ratio :** The inverse ratio or reciprocal ratio of a : b is $\dfrac{1}{a} : \dfrac{1}{b}$ i.e., b : a.

13.1.4 Proportion

Equality of two ratios is called proportion.

If a : b = c : d, then a, b, c and d are in proportional, a : b = c : d is also represented as a : b :: c : d.

(i)   The first and the fourth (last) term are called extremes and the second and third terms are called middle terms or means.

(ii)   In a proportion a : b :: c : d.

Product of extremes = product of means.

For example : 1 : 4 :: 3 : 12 is a proportional here

we see 1 × 12 = 4 × 3   ⟹   12 = 12.

(iii)   If a : b :: c : d then b : a :: d : c   or $\dfrac{a}{b} = \dfrac{c}{d} \Leftrightarrow \dfrac{b}{a} = \dfrac{d}{c}$

This is known as **Invertendo**.

(iv)   If a : b :: c : d then a : c :: b : d   or $\dfrac{a}{b} = \dfrac{c}{d} \Leftrightarrow \dfrac{a}{c} = \dfrac{b}{d}$

This result is known as **Alternendo**.

(v)   If a : b :: c : d

$\Rightarrow \quad \dfrac{a}{b} + 1 = \dfrac{c}{d} + 1 \qquad\qquad \Rightarrow \quad \dfrac{a+b}{b} = \dfrac{c+d}{d}$

or   a : b :: c : d $\Leftrightarrow$ (a + b) : b :: (c + d) : d   .... (A)

This result is known as **Componendo**.

(vi)   If a : b :: c : d

$\Rightarrow \quad \dfrac{a}{b} - 1 = \dfrac{c}{d} - 1 \qquad\qquad \Rightarrow \quad \dfrac{a-b}{b} = \dfrac{c-d}{d}$

or   a : b :: c : d $\Leftrightarrow$ (a – b) : b :: (c –d) : d   .... (B)

This result is known as **Dividendo**.

(vii)   Dividing equation (A) and (B) we get

$$\dfrac{\dfrac{a+b}{b}}{\dfrac{a-b}{b}} = \dfrac{\dfrac{c+d}{d}}{\dfrac{c-d}{d}} \Rightarrow (a+b):(a-b)::(c+d)\,(c-d)$$

or   a : b :: c : d $\Leftrightarrow$ (a + b) : (a – b) :: (c + d) (c – d)

This result is known as **Componendo** and **Dividendo**.

(viii)   a, b, c, d are said to be in continued proportion.

If $\dfrac{a}{b} = \dfrac{b}{c} = \dfrac{c}{d}$

PERCENTAGE

13.2 INTRODUCTION (PERCENTAGE)

The word percent means per hundred or for every hundred. The symbol % is used for the term percent.

Thus 20 percent written as 20% and it means 20 out of 100. This can also be written as $\dfrac{20}{100}$.

13.2.1 Interpretation of Percentage

In a class of 50 students, 40% are girls. How many girls are there ?
The given statement means that,
If the class strength is 100, out of them 40 are girls.

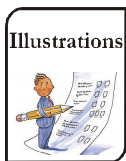$\therefore$ If the class strength is 50, number of girls $= \dfrac{50 \times 40}{100} = 20$

Rahul says his salary is ₹20,000 per month. He saves 35% of it. How much does he save ?
He means for every ₹100, he saves ₹35.

$\therefore$ For ₹20,000, he saves $= \dfrac{20,000 \times 35}{100} = ₹7000.$

13.2.2 Conversion of percent into fraction :

To convert a percent into fraction, divide it by 100 and remove the % sign.
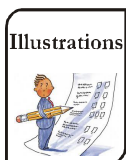
Illustrations

Illustration 3

Convert 15% into fraction.

Solution :

$$15\% = \frac{15}{100}$$

13.2.3 Conversion of fraction into percent

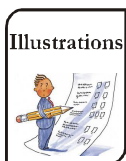To convert any fraction to percent, multiply it by 100 and put the % sign.

Illustrations

Illustration 4

Convert $\frac{2}{5}$ into percent.

Solution :

$$\frac{2}{5} = \frac{2}{5} \times 100\% = 40\%$$

13.2.4 Conversion of percent into ratio

First change the percent into fraction by dividing it by 100 and remove the % sign, finally reduce the obtained fraction into its simplest form.

Illustrations

Illustration 5

Convert 35%, 0.65% and 4.5% into ratio.

Solution

$$35\% = \frac{35}{100} = \frac{7}{20} = 7 : 20.$$

$$0.65\% = \frac{0.65}{100} = \frac{65}{10000} = \frac{13}{2000} = 13 : 2000.$$

$$4.5\% = \frac{4.5}{100} = \frac{45}{1000} = \frac{9}{200} = 9 : 200.$$

13.2.5 Conversion of ratio into percent

$$3:4 = \frac{3}{4} = \left(\frac{3}{4} \times 100\right)\% = 75\%$$

13.2.6 Conversion of percent into decimal

To convert the percent to decimal, first change it to fraction by dividing it by 100 and remove the %sign, finally put the decimal point accordingly.
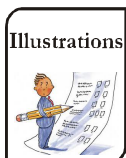
Illustrations

Illustration 6

Convert 18% to decimal.

Solution

$$18\% = \frac{18}{100} = 0.18$$

13.2.7 Conversion of decimal to percent

First change the decimal into fraction and then multiply by 100 and put the % sign.
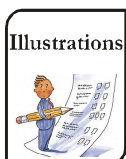
Illustrations

Illustration 7

Convert 1.5 and 0.25 to percent.

Solution

$$1.5 = \frac{15}{10} = \left(\frac{15}{10} \times 100\right)\% = 150\%$$

$$0.25 = \frac{25}{100} = \left(\frac{25}{100} \times 100\right)\% = 25\%$$

13.2.8 Percentage of a number

To find percentage of a given number, multiply the given number by required percentage.

Illustrations

Illustration 8

Find 20% of 400.

Solution

Let the required value is x.

∴   x = 20% of 400

$$x = \frac{20}{100} \times 400 = 80$$

∴   20% of 400 is 80.

13.2.9 Original number from its percentage

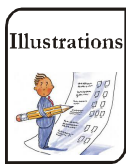**Illustrations**

Illustration 9
    Find the number whose 20% is 60.
Solution
    Let the required number is x.
    Now, 20 % of x is 60.

$\Rightarrow$ 20% of x = 60 $\Rightarrow$ $\dfrac{20}{100} \times x = 60$

$\Rightarrow$ $x = \dfrac{60 \times 100}{20} = 300$ $\therefore$ The required number is 300.

13.2.10 Percentage of one quantity to another quantity

If x% of a is b, then $\dfrac{x}{100} \times a = b$

$\Rightarrow$ $x = \dfrac{100b}{a}$
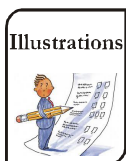
Illustrations

Illustration 10
    What percent of 120 is 30.
Solution
    Let x% of 120 = 30.

$\therefore$ $\dfrac{x}{100} \times 120 = 30$

      $x = \dfrac{30 \times 100}{120} = 25$

$\therefore$ 25% of 120 is 30.

IMPORTANT RESULTS
(i)   If there is an increase in any number or quantity from A to B then percentage increase

$$= \left(\dfrac{\text{increase in number (or quantity)}}{\text{original number (or quantity)}} \times 100 \right) \%$$

(ii)   If there is a decrease in any number or quantity from A to B then percentage decrease

$$= \left(\dfrac{\text{decrease in number (or quantity)}}{\text{original number (or quantity)}} \times 100 \right) \%$$

(iii)   If a quantity increase by n% then

New quantity   = original quantity + increase in quantity

= original quantity + n% of original quantity

= original quantity + $\dfrac{n}{100}$ of original quantity

New quantity = $\left(1 + \dfrac{n}{100}\right) \times$ original quantity

(iv)   If a quantity decreases by n% then

New quantity = $\left(1 - \dfrac{n}{100}\right) \times$ original quantity

(v)   When two quantities say A and B are given such that A > B, then

(a)   The percentage by which greater quantity (A) is greater than smaller quantity (B)

% increase = $\left(\dfrac{A - B}{B} \times 100\right)\%$

(b)   The percent by which small quantity is less than the bigger quantity

% decrease = $\left(\dfrac{A - B}{A} \times 100\right)\%$

(vi)   When a number A exceeds another number B by x%, then B is less than A by $\left(\dfrac{x}{100 + x} \times 100\right)\%$

(vii)   When a number A is less than number B by x%, then B is more than A by $\left(\dfrac{x}{100 - x} \times 100\right)\%$

13.2.11 Profit and Loss

Business transactions have become common feature of daily life. When we purchase and sale some items we either make profit or loss. Profit and loss are part of every business transactions. Let us first investigate them.

(i)   Cost Price : The Price at which a person buys an item is the Cost Price (C.P.) of that item for that person. In other words, amount paid or expenses in purchasing or producing an item is called its cost price (C.P.)

(ii)   Selling Price : The Price at which a person sells an item is the selling price (S.P.) of item for that person. In other words, amount received when an item sold is called selling price (S.P.) of that item to the seller.

(iii)   Profit : When a person sells an item at a price which is more than its cost price we say that person has made a profit or gain. The difference (S.P. – C.P.) is called profit or gain.
Thus profit or gain = S.P. – C.P, if S.P. > C.P.

(iv)   Loss : When a person sell an item at a price which is less than its cost price, we say that person has suffered loss. The difference (C.P. – S.P.) is called loss.

Thus Loss = C.P. – S.P. if S.P < C.P.

Basic Formulae :

(a)   Profit % = $\dfrac{profit \times 100}{C.P.}$ (b)   Loss % = $\dfrac{loss \times 100}{C.P.}$

When gain % is given :

(c)   S.P. = $\dfrac{(100 + gain\%) \times C.P.}{100}$ (d)   C.P. = $\dfrac{S.P. \times 100}{100 + gain\%}$

When loss % is given :

(e)   S.P. = $\dfrac{(100 - loss\%) \times C.P.}{100}$ (f)   C.P. = $\dfrac{S.P. \times 100}{100 - loss\%}$

Note : Profit or loss percent is always calculated on C.P.

(v)   Overheads :
All the expenses that a buyer paid on transportation or repair of purchased item are called overheads. All over heads are added to basic Cost Price (C.P.) of that item.

(vi)   Discount : sometimes to increase the sales or dispose off the old stock, dealer or seller offers his goods at reduced prices. This reduction in price offered by dealer/seller is called discount.

(vii)   Marked Price (M.P.): The printed price or the tagged price of an article is called its marked price (M.P.). It is also called list price.
Discount is always calculated on M.P. on the article.
Now,   Selling Price (S.P.) = M.P. – Discount
∴   Discount = M.P. – S.P.

% Discount = $\dfrac{Discount}{M.P.} \times 100$

% Discount = $\dfrac{M.P. - S.P.}{M.P.} \times 100$

(viii)   Sales Tax (ST) or Value Added Tax (VAT) : When we are presented with a bill in any shop, there is always a small amount which is added to the total amount of our bill. This is called sales tax. Sales tax is charged by the government on the sale of an item and charged on the selling price of the item.
VAT is calculated as a percentage of selling price and is added to the total amount of the bill.

COMPOUND INTEREST

13.3 INTRODUCTION (COMPOUND INTEREST)

Interest is the money paid by a borrower to the lender for using the money for a specified period of time. For example, if person A borrows ₹100 from person B, for a period of one year on the condition that he would repay ₹110 at the end of a year, the additional money of ₹10 is the interest. A is the borrower and B is the lender and ₹100 is the principal. The definitions of certains terms which are used frequency in this chapter are given below :

Formula for the computation of Simple Interest
Let P be the principal in rupees, R be the rate of interest and T denote the number of years.

Then, simple Interest (S.I.) $= \dfrac{PTR}{100}$

Also, Amount (A) = Principal (P) + Simple Interest (S.I.) $= P + \dfrac{PTR}{100} = P\left(1 + \dfrac{RT}{100}\right)$

13.3.1 Compound Interest

In compound interest, the interest at the end of a year/period is added to the principal to arrive at the new principal for the next year/period.

That means, the amount at then end of the year/period will become the principal for the second year/period. The amount at the end of the second year/period becomes the principal for the third year/period and so on.

Formulae used to compute amount (A) and C.I. are

$$A = P\left(1 + \dfrac{R}{100}\right)^{n} \text{ and C.I.} = A - P = P\left\{\left(1 + \dfrac{R}{100}\right)^{n} - 1\right\}$$

Here the interest is compounded annually

A is amount, **P** is the Principal, **R** is the rate of interest per annum and **n** is the number of years.

Important point to be noted with reference to simple interest and compound interest.

1. When the interest is compounded annually, the compound interest for the first year and the simple interest for the first year are equal.

2. Under simple interest, the principal remains the same thoughtout the time period. Under compound interest, the amount at the end of a period becomes the principal for the next period. In other words, under simple interest, there is interest on principal but under compound interest, there is interest on principal as well as interest on interest.
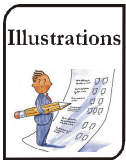
Illustration 11

Shailesh lends a sum of ₹6000 to Kalyan at the rate of 10% p.a. compounded annually. Find the amount at the end of 2 years.

Solution

Principal, P_1 = ₹6000

Rate of interest, R = 10%

Time period = 2 years

Interest for the first year, $I = \dfrac{P_1 TR}{100} = \dfrac{6000 \times 1 \times 10}{100} = ₹600$

∴   Principal for 2nd year $(P_2) = P_1 + I = ₹6000 + ₹600 = ₹6600$

Interest for the 2nd year $= \dfrac{P_2 TR}{100} = \dfrac{6600 \times 1 \times 10}{100} = ₹660$

∴   Amount at the end of 2 years.

= P + Interest for 1st year + Interest for 2nd year

= ₹6000 + ₹600 + ₹660 = ₹7260

Alternate method

$A = P\left(1 + \dfrac{R}{100}\right)^n = 6000\left(1 + \dfrac{10}{100}\right)^2 = 6000\left(\dfrac{11}{100}\right)^2 = 60 \times 121 = 7260$

⇒   A = ₹7260

13.3.2 Common Terms

1.   **Principal :** The money borrowed or lent out is called the principal.
2.   **Interest :** The additional money paid by the borrower in terms of some percentage of the principal is called the interest.
3.   **Amount :** The total money (interest + principal) paid by the borrower is called the amount.
4.   **Rate of Interest :** The interest paid yearly or per annum on every Rs. 100 is called the rate per cent per annum.
5.   **Time :** The period for which the sum is borrowed is called the time.
6.   **Simple Interest :** If the principal remains the same throughout the loan period, then the interest paid by the borrower is called the simple interest.

13.3.3 Conversion period

So far we considered only those situations in which interest was calculated on per annum on yearly basis. However, it is not necessary that the interest be compounded annually. In banks and financial institutions, usually the interest is compounded twice a year (half-yearly) or four times a year (quarterly). If the interest is compounded half-yearly, it means the interest is calculated and added to the principal after every six months. The period at the end of which the interest is compounded is called conversion period. For example, if the interest is calculated and added after every six months (half-yearly), then the conversion period is six months.

Note : If the conversion period is not mentioned, it is taken to be as 1 year.

Now, let see how the formula for finding compound interest gets changed if the conversion period is six months.

In $A = P\left(1 + \dfrac{R}{100}\right)^n$

P is principal
R is rate percent per year and
n is time in years.

(1)   If the interest is compounced half-yearly, then

$$Rate = \dfrac{R}{2} \text{ \% per half-year, and}$$

Time = 2n half-years
So, in this case, amount after n years (2n half-years) is given by

$$A = P\left(1 + \dfrac{R/2}{100}\right)^{2n}$$

(2)   If the interest is compounded quarterly

$$A = P\left(1 + \dfrac{R/4}{100}\right)^{4n}$$

(3)   If interest is compounded monthly

$$A = P\left(1 + \dfrac{R/12}{100}\right)^{12n}$$

13.3.4 Growth and Depreciation

For finding growth in population, increase in cost of goods, decrease in the quantity of mineral deposits, etc., the rate of interest is compounded.

(i)   For appreciation or growth, the formula for the value after appreciation is

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

Where P is the original vlaue.
        R is the rate of growth.
        n is the time period in years.

(ii)   For depreciation or decrease, the formula for the value after depreciation is

$$D = P\left(1 - \dfrac{R}{100}\right)^n$$

∴   Appreciation = A – P and Depreciation = P – D

(iii)   If the rate of growth in the first year, is R_1 % and in 2nd year is R_2%, then the value at the end of two years is given by,

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

(iv)   If P be the population of a country (or value of an article etc.) at a certain time, which increases at the rate R_1% per year for first n_1 years and decreases at the rate of R_2% per year for next n_2 years, then the population at the end of $(n_1 + n_2)$ year are given by

$$A = P\left(1 + \frac{R_1}{100}\right)^{n_1} \cdot \left(1 - \frac{R_2}{100}\right)^{n_2}$$

This formula can be extended for more than 2 different periods and rates.

Illustrations

Illustration 12

Sam deposited ₹7500 in a bank which pays him 12% interest per annum compounded quarterly. What is the amount which she receives after 9 months ?

Solution

Here, P = ₹7500, R = 12% per annum and n = 9 months = $\frac{9}{12}$ year = $\frac{3}{4}$ year.

∴   Amount after 9 months $= P\left(1 + \frac{R}{400}\right)^{4n} = ₹7500 \times \left(1 + \frac{12}{400}\right)^{4 \times \frac{3}{4}}$

$= ₹7500 \times \left(1 + \frac{3}{100}\right)^3 = ₹7500 \times \frac{103}{100} \times \frac{103}{100} \times \frac{103}{100} = ₹8195.45$

Illustration 13

Ram Singh bought a refrigerator for ₹4000 on credit. The rate of interest for the first year is 5% and of the second year is 15%. How much will it cost him if he pays the amount after two years.

Solution

Here, P = ₹4000, R_1 = 5% per annum and R_2 = 15% per annum.

∴   Amount after 2 years $= P\left(1 + \frac{R_1}{100}\right)\left(1 + \frac{R_2}{100}\right)$

$= ₹4000 \times \left(1 + \frac{5}{100}\right)\left(1 + \frac{15}{100}\right)$

$= ₹4000 \times \left(1 + \frac{1}{20}\right)\left(1 + \frac{3}{20}\right)$

$= ₹4000 \times \frac{21}{20} \times \frac{23}{20} = ₹4830.$

Thus, the refrigerator will cost ₹4830 to Ram Singh.

Illustration 14

The price value of the share of a company increased at the rate of 20% in a year and decreased at the rate of 10% in the year. If the present value of the share is ₹1000, then what will be its value after 2 years ?

Solution

Let P = ₹1000

Rate of increase, $R_1 = 20\%$

Rate of decrease, $R_2 = 10\%$

$\therefore$ Changed value $A = P\left(1 + \dfrac{R_1}{100}\right)\left(1 - \dfrac{R_2}{100}\right)$

$$= 1000\left(1 + \dfrac{20}{100}\right)\left(1 - \dfrac{10}{100}\right) = 1000 \times \dfrac{6}{5} \times \dfrac{9}{10} = ₹1080$$

Illustration 15

The value of a machine depreciates by 10% annually. If the present value of the machine is ₹100000, what will be its value after 2 years ?

Solution

Present value = ₹100000

Rate of depreciation = 10%

$\therefore$ Value after 2 years $= ₹100000\left(1 - \dfrac{10}{100}\right)^2 = ₹100000 \times \dfrac{9}{10} \times \dfrac{9}{10} = ₹81000$

SOLVED EXAMPLE

Example 1 :

    (i)   **Convert $2\dfrac{1}{12}$ % into a fraction.**   **(ii)**   **Convert $1\dfrac{11}{16}$ into per cent.**

    (iii)   **Convert 21 : 80 into a per cent.**   **(iv)**   **Express 36% as a decimal.**

Solution :

    (i) $2\dfrac{1}{12}\% = \dfrac{25}{12}\% = \dfrac{25}{12} \times \dfrac{1}{100} = \dfrac{1}{48}$

    (ii) $1\dfrac{11}{16}\% = \dfrac{27}{16} = \left(\dfrac{27}{16} \times 100\right)\% = \dfrac{27 \times 25}{4}\% = \dfrac{675}{4}\% = 168.75\%$

    (iii) $21 : 80 = \dfrac{21}{80} = \left(\dfrac{21}{80} \times 100\right) = \dfrac{105}{4}\% = 26.25\%$

    (iv) $36\% = \dfrac{36}{100} = 0.36.$

Example 2 :

    Divide Rs. 3000 Among A, B, C in the ratio 2 : 3 : 5.

Solution :

    A's share $= \left(\dfrac{2}{2+3+5}\right) \times 3000 = \dfrac{2}{10} \times 3000 = $ Rs. 600

    B's share $= \left(\dfrac{3}{2+3+5}\right) \times 3000 = \dfrac{3}{10} \times 3000 = $ Rs. 900

    C's share $= \left(\dfrac{5}{2+3+5}\right) \times 3000 = \dfrac{5}{10} \times 3000 = $ Rs. 1500

Example 3 :

    A bag contains coin of ₹5, ₹2 and ₹1 in the ratio 3 : 7 : 4, amounting to ₹1980. Find the number of coins of each type.

Solution :

    Ratio of coins : 3 : 7 : 4

    ∴   number of coins of ₹5, ₹2, ₹1 are 3x, 7x and 4x.

    Now, $5 \times (3x) + 2 \times (7x) + 1 \times (4x) = 1980$

    ⇒ $73x = 219 \times 20$ ⇒ $15x + 14x + 4x = 1980$

    ⇒ $x = \dfrac{219 \times 20}{73}$ ⇒ $33x = 1980$

    ∴ $x = \dfrac{1980}{33} = 60$ ⇒ $x = 60$

    ∴   No. of coins ₹5 $= 60 \times 3 = 180$

    No. of coins Rs. 2 $= 60 \times 7 = 420$

    No. of coins Rs. 1 $= 60 \times 4 = 240$

Example 4 :

If $\dfrac{a}{x-y} = \dfrac{b}{y-z} = \dfrac{c}{z-x}$, then prove that a + b + c = 0.

Solution :

Let $\dfrac{a}{x-y} = \dfrac{b}{y-z} = \dfrac{c}{z-x} = K$

$\therefore$ a = K(x − y), b = K(y − z), c = K(z − x)

Now   a + b + c = K(x − y) + K(y − z) + k (z − x)

                = K (x − y + y − z + z − x)

         a + b + c = K × 0 = 0

$\Rightarrow$ a + b + c = 0

Example 5 :

The sum of the present ages of A, B and C is 90 years. Six year ago, their ages were in the ratio 1 : 2 : 3. What is the present age of B.

Solution :

6 years ago the sum of the ages of A, B, C = 90 − 6 × 3 = 72 years.

Let 6 years ago ratio of ages = x : 2x : 3x

$\Rightarrow$ x + 2x + 3x = 72

$\Rightarrow$ 6x = 72

$\Rightarrow$ x = 12

6 years ago age of 'B' = 2 × 12 = 24 years

B's present age = 24 + 6 = 30 years.

Example 6 :

The sum of squares of three numbers a, b, c is 532. The ratio a : b and the ratio b : c is 3 : 2. What is the number 'b' ?

Solution :

$\dfrac{a}{b} = \dfrac{3}{2} = \dfrac{3 \times 3}{2 \times 3} = \dfrac{9}{6}$; $\dfrac{b}{c} = \dfrac{3}{2} = \dfrac{3 \times 2}{2 \times 2} = \dfrac{6}{4}$

[Making b same in both the cases]

Now, a : b : c = 9 : 6 : 4

$\therefore$ We let the three numbers are 9x, 6x and 4x.

$\therefore$ $(9x)^2 + (6x)^2 + (4x)^2 = 532$

         $133x^2 + 532$

         $x^2 = 4$

         x = 2

$\therefore$ b = 6 × 2 = 12

Example 7 :

If $\dfrac{x}{a} = \dfrac{y}{b} = \dfrac{z}{c}$, then prove that each ratio is equal to $\left(\dfrac{2ax + 5by + 7cz}{2a^2 + 5b^2 + 7c^2}\right)$.

Solution :

Let $\quad \dfrac{x}{a} = \dfrac{y}{b} = \dfrac{z}{c} = K$

$\Rightarrow \quad x = aK,\; y = bK,\; z = cK$

Now $\left(\dfrac{2ax + 5by + 7cz}{2a^2 + 5b^2 + 7c^2}\right) = \dfrac{2a \times aK + 5b \times bK + 7c \times cK}{2a^2 + 5b^2 + 7c^2} = K\left(\dfrac{2a^2 + 5b^2 + 7c^2}{2a^2 + 5b^2 + 7c^2}\right) = K$

Example 8 :

Find the third proportional be 5, 10.

Solution :

Let the third proportion be x.

$\therefore \quad \dfrac{5}{10} = \dfrac{10}{x}$

$\Rightarrow \quad 5x = 100 \qquad \Rightarrow \quad x = \dfrac{100}{5} = 20$

$\therefore \quad$ 20 is third proportional to 5 and 10.

Example 9 :

If $x = \dfrac{4ab}{a+b}$, find the value of $\dfrac{x+2a}{x-2a} + \dfrac{x+2b}{x-2b}$.

Solution :

$x = \dfrac{4ab}{a+b} \qquad\qquad \Rightarrow \quad \dfrac{x}{2a} = \dfrac{2b}{a+b}$

Applying componendo and Dividendo.

$\dfrac{x+2a}{x-2a} = \dfrac{2b+a+b}{2b-a-b} = \dfrac{a+3b}{b-a}$

also $\quad x = \dfrac{4a}{a+b} \qquad\qquad \Rightarrow \quad \dfrac{x}{2b} = \dfrac{2a}{a+b}$.

Applying Componendo and Dividendo.

$\dfrac{x+2b}{x-2b} = \dfrac{2a+a+b}{2a-a-b} = \dfrac{3a+b}{a-b}$

Adding (A) and (B)

$\dfrac{x+2a}{x-2a} + \dfrac{x+2b}{x-2b} = \dfrac{a+3b}{b-a} + \dfrac{3a+b}{a-b} = \dfrac{a+3b}{b-a} - \dfrac{3a+b}{b-a} = \dfrac{a+3b-3a+b}{b-a}$

$\dfrac{x+2a}{x-2a} + \dfrac{x+2b}{x-2b} = \dfrac{2(b-a)}{(b-a)} = 2.$

Example 10 :

    Find the ratio of third proportional to 12 and 30 and the means proportional between 9 and 25.

Solution :

    Let third proportional to 12 and 30 be x.

$$\therefore \quad \frac{12}{30} = \frac{30}{x} \qquad \Rightarrow \qquad x = \frac{30 \times 30}{12} = 75$$

    Mean proportional between 9 and 25 $= \sqrt{9 \times 25} = \sqrt{225} = 15$

$$\therefore \quad \text{Ratio} = 75 : 15 = 5 : 1.$$

Example 11 :

    60kg of an alloy A is mixed with 100kg 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 find the amount of tin in the new alloy.

Solution :

$$\text{Quantity of tin in 60kg of 'A'} = \left(\frac{2}{5} \times 60 \right) = 24 \text{ kg}$$

$$\text{Quantity of tin in 100kg of 'B'} = \left(\frac{1}{5} \times 100 \right) = 20 \text{ kg}$$

$$\therefore \quad \text{Quantity of tin in new alloy} = (20 + 24) = 44 \text{ kg}$$

Example 12 :

    The ratio of 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 ₹1600, then find the income of A.

Solution :

    Since the ratio of income is 5 : 4 and ratio of expenditure is 3 : 2

$\therefore$ We can suppose income of A and B be 5x and 4x respectively.

And expenditure of A and B be 3y and 2y respectively.

Now $5x - 3y = 1600$

        $4x - 2y = 1600$

Multiply (1) by 2 and (2) by 3 and subtract

we get $2x = 1600$ $\Rightarrow$ $x = 800$

$\therefore$ Income of 'A' $= 5 \times 800 = ₹4000.$

Example 13 :

    The ratio of the length of the human body to the length of the head is about 8 : 1. What is the length of the head of a person who is 168 cm tall ?

Solution :

$$\frac{\text{length of human body}}{\text{Length of head}} = \frac{8}{1} \quad \Rightarrow \quad \text{Length of head} = \frac{1}{9} \times 168 = 18.66 \text{ cm}$$

Example 14 :

Express 375 in the form of $\dfrac{p}{q}$.

Solution :

$$\dfrac{375}{1}$$

Example 15 :

Why the ratio 3 : 2 is in simplest form ?

Solution :

Because the only common factor of the term is 1.

Example 16 :

Given ratios are all equivalent to 4 : 3 for each, tell by which numbers both terms were multiplied.

(i) 12 : 9   (ii) 8 : 6   (iii) 16 :12   (iv) 24 : 18

Solution :

(i) 3   (ii) 2   (iii) 4   (iv) 6

Example 17 :

The ratio in each part are equivalent, find the missing term.

(a) 4 : 5   (b) 2 : 3   (c) 15 : 25

$\boxed{}$: 25   12 : $\boxed{}$ $\boxed{}$: 5

Solution :

(a) 20   (b) 18   (c) 3

Example 18 :

Write three equivalent ratio for each ratio ?

(a) 2 : 3   (b) 3 : 12   (c) 6 : 10

Solution :

(a)   4 : 6 ,   6 : 9,   8 : 12
(b)   6 : 24,   9 : 36,   12 : 48
(c)   12 : 20,   18 : 30,   24 : 40

Example 19 :

P_1% of number N_1 is equal to P_2 % of number N_2. Find what percent of N_1 is N_2 ?

Solution :

We are required to find $\dfrac{N_2}{N_1} \times 100\%$

Given $\dfrac{P_1}{100} \times N_1 = \dfrac{P_2}{100} \times N_2$ $\Rightarrow$ $\dfrac{N_2}{N_1} = \dfrac{P_1}{P_2}$

$\therefore$ $\dfrac{N_2}{N_1} \times 100\% = \dfrac{P_1}{P_2} \times 100\%$

Example 20:

A number exceeds B by 25%. By what % is B short of A?

Solution :

$$\% \text{ short} = \left(\frac{\% \text{ excess}}{100 + \% \text{ excess}} \right) \times 100\% = \left(\frac{25}{100 + 25} \right) \times 100\%$$

$$\therefore \qquad \% \text{ short} = 20\%$$

Example 21 :

The side of a square increases by A% then find by what percent does its area increases ?

Solution :

Let the side of square be 'x' units

$\therefore \qquad$ Area of square $= x \cdot x = x^2$ units.

After increase, side of square is $\left(x + \dfrac{Ax}{100} \right)$ units $= x \left(1 + \dfrac{A}{100} \right)$ units

New area of square $= x^2 \left(1 + \dfrac{A}{100} \right)^2$ units

Now, increase in area $= x^2 \left(1 + \dfrac{A}{100} \right)^2 - x^2 = x^2 \left[\left(1 + \dfrac{A}{100} \right)^2 - 1 \right]$

$$= x^2 \left[\frac{A}{100} \left(2 + \frac{A}{100} \right) \right] \qquad\qquad [\text{using } p^2 - q^2 = (p + q)\,(p - q)]$$

$$\% \text{ increase in area} = \frac{x^2 \left[\dfrac{A}{100} \left(2 + \dfrac{A}{100} \right) \right]}{x^2} \times 100\%$$

$$\% \text{ increase in area} = \left(2A + \frac{A^2}{100} \right) \%$$

Example 22 :

If 10% of an electricity bill is deduced, ₹45 is still to be paid. How much was the bill ?

Solution :

Let the bill amount was Rs. 'x'

$\therefore \ x - 10\% \text{ of } x = 45$

$\Rightarrow \qquad x - 10 \times \dfrac{x}{100} = 45 \qquad \Rightarrow \qquad \dfrac{9x}{10} = 45$

$\Rightarrow \qquad x = ₹50$

Example 23 :

 If 120 is 20% of a number, then what will be 120% of that number ?

Solution :

 Let the number be 'x'.

 $\therefore$ 20% of x = 120.

 $\Rightarrow$ $20 \times \dfrac{x}{100} = 120$ $\Rightarrow$ x = 600

 Now 120% of 600 = $120 \times \dfrac{600}{100} = 720$

Example 24 :

 When 75% of a number is added to 75 the result is the same number. Find the number.

Solution :

 Let the required number be x.

 Now 75% of x + 75 = x

 $\Rightarrow$ $\dfrac{75x}{100} + 75 = x$ $\Rightarrow$ $x - \dfrac{3}{4}x = 75$

 $\Rightarrow$ $\dfrac{x}{4} = 75$ $\Rightarrow$ x = 300.

Example 25 :

 Naresh secured 50% marks in Hindi, 60% in English and 70% in Maths as well as Science. What were his total marks, if the maximum obtained in each of these 4 subjects was 50 ?

Solution :

 Total marks = 50% of 50 + 60% of 50 + 70% of 50 + 70% of 50

 $= 50 \times \dfrac{50}{100} + \dfrac{60}{100} \times 50 + \dfrac{70}{100} \times 50 + \dfrac{70}{100} \times 50$

 $= 25 + 30 + 35 + 35 = 125$ Total marks

Example 26 :

 Suresh bought a cycle for ₹750 and sold it for ₹675. Find his percentage loss.

Solution :

 Given CP = ₹750, SP = ₹675

 CP > SP

 $\therefore$ Loss = CP – SP

 Loss = 750 – 675 = ₹75

 $\therefore$ % Loss = $\dfrac{Loss \times 100}{CP} = \dfrac{75 \times 100}{750} = 10\%$

Example 27 :

A fruit seller has 1600 fruits. 20% of these are apples, 35% are oranges and the rest are mangoes. Find the number of fruits of each kind.

Solution :

Apples are 20% of 1600.

$\therefore$ Number of apples $= \dfrac{20}{100} \times 1600 = 320$

Oranges are 35% of 1600

$\therefore$ Number of oranges $= \dfrac{35}{100} \times 1600 = 560$

Mangoes are $(100 - 20 - 35)\%$ of 1600
or mangoes are 45% of 1600

$\therefore$ Number of mangoes $= \dfrac{45}{100} \times 1600 = 720$

Example 28 :

Mona's salary is 10% more than Shruti's. How much per cent is Shruti's income less than Mona's ?

Solution :

Suppose Shruti's income $= ₹100$

$\therefore$ Mona's income $= ₹(100 + 10) = ₹110$

If Mona's income is $₹110$, then Shruti's income $= ₹100$

If Mona's income is $₹1$, then Shruti's income $= ₹\dfrac{100}{110}$

If Mona's income is $₹100$, then Shruti's income $= ₹\dfrac{100}{110} \times 100 = ₹\dfrac{1000}{110} = ₹90\dfrac{10}{11}$

$\therefore$ Shruti's income is $\left(100 - 90\dfrac{10}{11}\right)$ or $9\dfrac{1}{11}\%$ less then Mona's income.

Example 29 :

A number is increased by 20% and then decreased by 20%. Find the net increase or decrease percent.

Solution :

Let the number $= 100$

$\therefore$ Number after 20% increase $= 100 + 20 = 120$

Decrease in the new number $= 20\%$ of 120

$$= \dfrac{20}{100} \times 120 = 24$$

$\therefore$ Final number $= 120 - 24 = 96$

$\therefore$ Net decrease $= 100 - 96 = 4$

Hence there is a net decrease of 4%.

Example 30 :

     In an election, there are only two candidates. The winner polled 55% votes and won by a margin of 8756 votes. Find the total number of votes polled.

Solution :

     Suppose number of vote polled = 100

     Votes polled in favour of winning candidate = 55% of 100 = 55

     Votes polled in favour of other candidate = 100 – 55 = 45

     Difference in votes polled = 55 – 45 = 10

     If the difference is 10, then total votes polled = 100

     If difference is 8756, then total votes polled = $\dfrac{100}{10} \times 8756 = 87560$

Example 31 :

     A man sells of a sofa set at a gain of 5%. Had he sold it for ₹490 less, he would have lost 2%. Find the cost price of the sofa set.

Solution :

     Suppose C.P. of the sofa set = Rs. x

     Gain = 5%

     S.P. = ₹ $\dfrac{(100+5)\times x}{100}$ = ₹ $\dfrac{21}{20}$ x

     Loss = 2%

     S.P. = ₹ $\dfrac{(100-2)\times x}{100}$ = ₹ $\dfrac{49}{50}$ x

     Difference in two S.P.s = ₹ $\left(\dfrac{21}{20}x - \dfrac{49}{50}x\right)$ = ₹ $\left(\dfrac{105-98}{100}\right)x$ = ₹ $\dfrac{7}{100}x$

     If difference in S.P. is ₹ $\dfrac{7}{100}$ x, then C.P. = ₹x

     If difference in S.P. is ₹490, then C.P. = ₹ $\dfrac{x \times 490 \times 100}{7 \times x}$ = ₹7000

     Hence the C.P. of sofa set is ₹7000

Example 32:

     On the eve of Gandhi Jayanti a carpet is sold for ₹9720 after allowing 20% discount. What is its marked price ?

Solution :

     Suppose marked price = ₹100

     Discount = ₹20

    ∴   Net price (or S.P.) = ₹100 – ₹20 = ₹80

         If ₹80 is the S.P. then marked price = ₹100

    ∴   If ₹9720 is the S.P. then marked price = ₹ $\dfrac{100 \times 9720}{80}$ = ₹12150.

Example 33 :

An article is marked 20% above cost price. The shopkeeper allows discount of 12% on it. Find his gain or loss percent.

Solution :

Suppose C.P. = ₹100

Marked price = ₹100 + ₹20 = ₹120

Discount = ₹ $\dfrac{12}{100} \times 120$ = ₹14.40

∴   S.P. = ₹120 – ₹14.40 = ₹105.60

∴   Gain = ₹105.60 – ₹100 = ₹5.60

∴   Gain % = $\dfrac{5.60}{100} \times 100$ or 5.6%.

Example 34 :

A shopkeeper allows his customers 10% discount and still gains 8%. What is the actual cost of a sofa which he has marked at ₹6000 ?

Solution :

Marked price = ₹6000

Discount = ₹ $\dfrac{6000 \times 10}{100}$ = ₹600

S.P. = ₹6000 – ₹600 = ₹5400

Gain = 8%

C.P. = $\dfrac{\text{S.P.} \times 100}{100 + \text{gain}\%}$ = ₹ $\dfrac{5400 \times 100}{100 + 8}$ = ₹ $\dfrac{5400 \times 100}{108}$ = ₹5000.

Example 35 :

Express as fraction.

(a) 35%   **(b) 46%**   **(c) 23%**

Solution :

(a) 35% = $\dfrac{35}{100} = \dfrac{7}{20}$ **(b) 46%** = $\dfrac{46}{100} = \dfrac{23}{50}$ **(c) 23%** = $\dfrac{23}{100}$

Example 36:

Express as percentage.

(a) $\dfrac{1}{4}$ **(b)** $\dfrac{3}{5}$ **(c)** $\dfrac{9}{10}$

Solution :

(a) $\dfrac{1}{4} = \dfrac{1}{4} \times 100\% = 25\%$

(b) $\dfrac{3}{5} = \dfrac{3}{5} \times 100\% = 60\%$

(c) $\dfrac{9}{10} = \dfrac{9}{10} \times 100\% = 90\%$

Example 37 :

In a school there are 3400 students. If 65% of them are boys, find the number of girls.

Solution :

Total number of students = 3400

Number of boys = 65% or 3400 = $\dfrac{65}{100} \times 3400 = 2210$

∴   Number of girls = 3400 – 2210 = 1190

Alternate method

Out of every 100 students, 65 are boys. This means that the remaining 35 are girls. So out of every 100 students, 35 are girls.

∴   Percentage of girls = 35%

∴   Number of girls = 35% of 3400 = $\dfrac{35}{100} \times 3400 = 1190$

Example 38 :

80kg of a fertilizer contains 25% of chemical A, 40% of chemical B and the rest is chemical C. Find the quantity of A, B and C in the fertilizer.

Solution :

Quantity of A = $\dfrac{25}{100} \times 80 = 20$ kg

Quantity of B = $\dfrac{40}{100} \times 80 = 32$ kg

Quantity of C = 80 – (20 + 32) = 28kg

Example 39 :

The price of an article is ₹460. After two months, its price increased by 15%. What is the price now ?

Solution :

Price of an article = ₹460

Increase in the price = 15% of 460 = $\dfrac{15}{100} \times 460 = ₹69$

∴   New price = old price + increased price = ₹460 + ₹69 = ₹529

Example 40 :

A mobile phone is sold for ₹5500 after allowing discount of 12%. What is the marked price?

Solution :

Let the marked price be ₹100.

Discount = 12% = $\dfrac{12}{100} \times 100 = 12$

∴   SP = 100 – 12 = ₹88

If SP is ₹88, MP is ₹100

If SP is ₹5500, MP = $\dfrac{5500 \times 100}{88} = ₹6250$

Example 41 :

A retailer bought a used washing machine for ₹2500, spent ₹850 on repairs and sold it at a gain of 10%. Find the selling price.

Solution :

CP = ₹2500

Overhead expenses = ₹850

∴   Total CP = ₹3350

Gain = 10%

∴ $SP = CP \times \dfrac{(100 + gain\%)}{100} = \dfrac{3350 \times 110}{100} = ₹3685$

Example 42:

A dress whose marked price is ₹360 is sold at a discount of 10%. If the shopkeeper still makes a profit of 20%, what is the cost of the dress.

Solution :

The marked price is ₹360

The selling price (SP) of this dress is 90% of the marked price.

     = 90% of ₹360   [∴ (100 – 10)% = 90%]

     $= \dfrac{90}{100} \times ₹360 = ₹324$

Now, let the cost price (CP) be x.

Since there is a profit of 20%, the selling price is 120% of the cost price x.

∴   SP = 120% of x.   [∴ (100 + 20)% = 120%]

     $= \dfrac{120}{100} \times x$

But we have calculated the selling price and found it to be ₹324.

∴ $\dfrac{120}{100} \times x = 324$

Or $x = \dfrac{324 \times 100}{120} = 270$

∴   The cost of the dress is ₹270.

Example 43 :

A packet of spice is marked 30% above the cost price. If the shopkeeper allows a discount of 20% on the marked price, what is his gain or loss percent ?

Solution :

Let the CP of the article be ₹100.

∴   The marked price = 130% of the CP.   [∴ (100 + 30)% = 130%]

           = 130% of ₹100 = ₹130

Selling price after a discount of 20% = 80% of the marked price.

           = 80% of ₹130

           $= \dfrac{80}{100} \times ₹130 = ₹104$

$\therefore$ Gain = ₹104 – Rs. 100 = ₹4

$\therefore$ %gain = $\dfrac{\text{Gain}}{\text{CP}} \times 100\% = \dfrac{4}{100} \times 100\% = 4\%$

Example 44 :

The cost of a table is ₹800. The sales tax charged is 4%. Find the bill amount.

Solution :

Selling Price (SP) of table = ₹800

Sales Tax = 4% of SP

$= \dfrac{4}{100} \times 800 = ₹32$

$\therefore$ Billing amount = ₹(800 + 32) = ₹832

Example 45 :

Suresh purchased a T.V. set of ₹15000 including VAT of 10%. Find the cost of TV set before VAT was added.

Solution :

Let the cost of TV set without VAT = ₹ x

Now, x + VAT = 15000

$\Rightarrow$ $x + x \times \dfrac{10}{100} = 15000$

$\Rightarrow$ $\dfrac{11x}{10} = 15000$

$\Rightarrow$ $x = \dfrac{15000 \times 10}{11} = 13636.3636$

$\therefore$ Cost of TV set before VAT is ₹13636.3636.

Example 46 :

In an election between two candidates A and B, A got 65% of the total votes and won the election by 2748 votes. Find the total number of votes cast if no vote is declared invalid.

Solution :

Let the total number of votes cast = x

No. of votes got by A = 65% of x = $\dfrac{65}{100}$ x

and numbers of votes got by B = 35% of = $\dfrac{35}{100}$ x

A.T.Q.,

$$\frac{65}{100}x - \frac{35}{100}x = 2748$$

$$\Rightarrow \quad \frac{30}{100}x = 2748$$

$$\Rightarrow \quad x = 9160.$$

∴   total number of votes cast are 9160.

Example 47 :

A man buys an article for ₹240 and sells it for ₹288. Find his gain percent.

Solution :

C.P. = ₹240, S.P. = 288

Gain = 288 – 240 = ₹48

and Gain % $= \dfrac{\text{Gain}}{\text{C.P.}} \times 100 = \dfrac{48}{240} \times 100 = 20\%$

Example 48 :

Maulic bought two horses at ₹40000 each. He sold one horse at 15% gain. But he had to sell the second horse at a loss. If he had suffered a loss of ₹3600 on the whole transaction, find the selling prices of the second horse.

Solution :

Total C.P. of the two horses = 2 × ₹40000 = ₹80000

Loss = ₹3600

∴   Total S.P. of two horses = ₹80000 – ₹3600 = ₹76400   .....(i)

Now, S.P. of the first horse at 15% profit

$$= \text{C.P.}\left(\frac{100 + \text{Profit}\%}{100}\right) = ₹40000\left(\frac{100 + 15}{100}\right) = ₹46000 \qquad .....(ii)$$

∴   S.P. of the second horse = ₹76400 – ₹46000 = ₹30400

[From (i) and (ii)]

Thus, the selling price of the second horse is ₹30400.

Example 49 :

By selling 288 hens, Malleshwari lost the S.P. of 12 hens. Find her loss percent.

Solution :

Let S.P. of 1 hen = ₹1

∴   S.P. of 288 hens = ₹288 × 1 = ₹288

and   Loss = S.P. of 12 hens = ₹12 × 1 = ₹12

∴   C.P. of 288 hens = S.P. + Loss

∴   ₹288 + ₹12 = ₹300

Therefore, loss % $= \dfrac{\text{Loss}}{\text{C.P.}} \times 100 = \dfrac{12}{300} \times 100 = 4$

Thus, Malleshwari's loss is 4%.

Example 50 :

A man sold two horses for ₹2970 each. On one he gains 10% while on the other he losses 10%. How much percent does he gain or loss on the whole transaction.

Solution :

Let. C.P. of one horse = ₹x

Gain % = 10

S.P. = x + $\dfrac{10}{100}$ x = 2970

$\Rightarrow \quad \dfrac{11x}{10} = 2970 \qquad\qquad (\because$ Given S.P. = ₹2970)

$\Rightarrow \quad x = \dfrac{2970 \times 10}{11} = ₹2700$

Let C.P. of another horse = ₹y

Loss % = 10

S.P. = y $- \dfrac{10}{100} \times$ y $\qquad \Rightarrow \quad \dfrac{9y}{10} = 2970$

$\Rightarrow \quad y = \dfrac{2970 \times 10}{9} \qquad \Rightarrow \quad y = ₹3300$

Total cost price = 3300 + 2700 = ₹6000

Total selling price = 2970 + 2970 = ₹5940

Since, C.P. > S.P., there will be loss.

Thus, loss = 6000 − 5940 = ₹60

and loss % = $\dfrac{60}{6000} \times 100 = 1$

Example 51 :

A table with marked price ₹2400 was sold to a customer for ₹2200. Find the rate of discount allowed on the table.

Solution :

M.P. = ₹2400, S.P. = ₹2200

∴ Discount = ₹2400 − ₹2200 = ₹ 200

Rate of discount = $\dfrac{\text{Discount}}{\text{M.P.}} \times 100$

$= \dfrac{200}{2400} \times 100 = 8\dfrac{1}{3}\%$

Example 52 :

A shirt was sold for ₹884 after allowing a discount of 15% on the marked price. Find the marked price of the shirt.

Solution :

Let M.P. be x.

$\therefore$ discount = 15% of ₹ x $= ₹ \dfrac{15}{100} \times x = ₹ \dfrac{3x}{20}$

$\therefore$ S.P. $= ₹\left(x - \dfrac{3x}{20} \right) = ₹ \dfrac{17x}{20}$

According to the question,

$\dfrac{17x}{20} = 884$ or $x = \dfrac{884 \times 20}{17} = 1040$

Thus, Marked price of the shirt is ₹1040.

Example 53 :

Rama and Riti run a readymade garments shop. They mark the garments at such a price that even after allowing a discount of 12.5%, they make a profit of 10%. Find the marked price of a suit which costs them ₹2940.

Solution :

C.P. of the suit = ₹2940

Profit = 10% of ₹2940

   $= ₹ \dfrac{10}{100} \times 2940 = ₹294$

$\therefore$ S.P. of the suit = ₹(2940 + 294) = ₹3234

Let the marked price be ₹100. Then,

discount = 12.5% of ₹100 = ₹12.50

$\therefore$ S.P. = ₹(100 – 12.50) = ₹87.50

Now, if S.P. is ₹ 87.50, M.P. = ₹ 100

$\therefore$ If S.P. is ₹3234, M.P.

   $= \dfrac{100}{87.50} \times 3234 = ₹3696$

Example 54 :

The price of a computer is ₹18,000. Service Tax (ST) is charged on it at the rate of 12%. Find the amount which the customer pays.

Sol. If the price is ₹ 100, after including ST the customer pay ₹ 112.

$\therefore$ If the price is 18,000, after ST the customer pays $= \dfrac{18000 \times 112}{100} = ₹20,160.$

Example 55 :

Mr. Sharma purchased some electronic items for ₹ 972 including 8% VAT. Find the price before VAT was added.

Sol.   The customer pays ₹ 108, if original price is ₹ 100.

∴   If customer pays ₹ 972, original price $= \dfrac{972 \times 100}{108} = $ ₹ 900.

Example 56 :

How long will it take ₹ 8000 to earn a simple interest of ₹ 1800 at 9% per annum ?

Solution :

P = ₹ 8000, R = 9% p.a.;   S.I. = ₹ 1800

∴   Time $= \dfrac{\text{S.I.}}{\text{P} \times \text{R}} = \dfrac{1800 \times 100}{8000 \times 9}$ years $(\text{R} = 9\% = \dfrac{9}{100})$

$= \dfrac{5}{2}$ or $2\dfrac{1}{2}$ years

Example 57 :

Shweta deposits a certain sum of money in a bank. If the interest rate of the bank decreases from $3\dfrac{3}{4}$ % to $3\dfrac{1}{2}$ % per annum, she receives ₹ 100 less in 2 yea₹ Find the sum of money she deposits.

Solution :

Suppose principal = ₹ 100;   Time = 2 years

Rate $= 3\dfrac{3}{4}$ % p.a.

∴   S.I. = ₹ $\dfrac{100 \times 2 \times 15}{100 \times 4}$ = ₹ $\dfrac{15}{2}$ ..... (i)

In the 2nd case, rate $= 3\dfrac{1}{2}$ % p.a.

∴   S.I. = ₹ $\dfrac{100 \times 2 \times 7}{100 \times 2}$ = ₹ 7   ..... (ii)

Difference in S. I. = (i) – (ii)

$= $ ₹ $\left(\dfrac{15}{2} - 7\right) = $ ₹ $\dfrac{1}{2}$

If difference in S.I. is Re $\dfrac{1}{2}$, then principal = ₹ 100

If difference in S.I. is ₹ 100, then principal = ₹ 100 × 2 × 100 = ₹ 20000

Example 58 :

Find the compound interest on ₹ 5000 at 8% per annum for 2 years.

Solution :

Principal = ₹ 5000;   Rate = 8%

Interest for 1st year = ₹ $\dfrac{5000 \times 8 \times 1}{100}$ = ₹ 400

∴   Amount at the end of 1st year = ₹ (5000 + 400) = ₹ 5400

∴   Principal for 2nd year = ₹ 5400

Interest for the 2nd year = ₹ $\dfrac{5400 \times 8 \times 1}{100}$ = ₹ 432

Amount at the end of 2nd year = ₹ (5400 + ₹ 432) = ₹ 5832

∴   Compound interest (C.I.) = ₹ (5832 – 5000) = ₹ 832

Example 59 :

Rita invests ₹ 93750 at 9.6% per annum for 3 years and the interest is compounded annually. Calculate

(i) the amount outstandsing to her at the end of the second year.

(i) the interest for the third year.

Solution :

(i)   Principal for 1st year = ₹ 93750; Rate = 9.6% per annum

Interest for the 1st year = $\dfrac{93750 \times 9.6 \times 1}{100}$ = ₹ 9000

Amount at the end of 1st year = ₹ (93750 + 9000) = ₹ 102750

∴   Principal for 2nd year = ₹ 102750

Interest for 2nd year = $\dfrac{102750 \times 9.6 \times 1}{100}$ = 9864

∴   Amount at the end of 2nd year = ₹ (102750 + 9864) = ₹ 112614

∴   The amount outstanding to her at the end of 2nd year is ₹ 112614.

(ii)   Principal for 3rd year = ₹ 112614

Interest for 3rd year = ₹ $\dfrac{112614 \times 9.6 \times 1}{100}$ = ₹ 10810.94

Example 60 :

Simple interest on a certain sum of money for 2 years at $6\dfrac{1}{2}$ % per annum is ₹ 5200. What will be the compound interest on that sum at the same rate and for the same period ?

Solution :

S.I. = ₹ 5200; Time = 2 years; Rate = $6\dfrac{1}{2}$ % p.a.

∴   Principal = $\dfrac{\text{S.I.}}{\text{Time} \times \text{Rate}}$ = ₹ $\dfrac{5200 \times 100}{2 \times 6\dfrac{1}{2}}$ ... ($\because$ R = $6\dfrac{1}{2}$ %)

= ₹ $\dfrac{5200 \times 100 \times 2}{2 \times 13}$ = ₹ 40000

Now amount when interest is compounded annually

Amount = $P(1 + R)^n$

$$= ₹\ 40000 \left(1 + \frac{6\frac{1}{2}}{100}\right)^2 = ₹\ 40000 \left(1 + \frac{13}{200}\right)^2$$

$$= ₹\ 40000 \times \frac{213}{200} \times \frac{213}{200} = ₹\ 45369$$

∴   Compound interest = ₹ (45369 – 40000) = ₹ 5369.

Example 61 :

Kanika deposited ₹ 20000 for one year in fixed deposit with State Bank of India. If the bank pays 8% interest per annum and the interestis calculated half-yearly, what amount will she get after one year ?

Solution :

Principal = ₹ 20000

Rate = 8% per annum = 4% half-yearly

∴   A = $P(1 + R)^n$

$$= ₹\ 20000 \left(1 + \frac{4}{100}\right)^2 = ₹\ 20000 \times \frac{26}{25} \times \frac{26}{25} = ₹\ 21632$$

Example 62 :

What sum will become ₹ 9261 at 5% per annum compound interest after 3 years ?

Solution :

Here A = ₹ 9261, R = 5% per annum, n = 3 years

∴   A = $P(1 + R)^n$

$$9261 = P\left(1 + \frac{5}{100}\right)^3 = P\left(\frac{21}{20}\right)^3$$

∴ $P = 9261 \times \left(\frac{21}{20}\right)^3 = \dfrac{9261 \times 20 \times 20 \times 20}{21 \times 21 \times 21} = 8000$

∴   Principal = ₹ 8000

Example 63 :

After how many years will ₹ 1600 become ₹ 2025 at $12\frac{1}{2}$ % per annum compound interest ?

Solution :

Here   A = ₹ 2025, P = ₹ 1600, R = $12\frac{1}{2}$ % per annum

∴   A = $P(1 + R)^n$

$$2025 = 1600\left(1 + \frac{25}{200}\right)^n = 1600\left(1 + \frac{1}{8}\right)^n$$

$$\left(1 + \frac{1}{8}\right)^n = \frac{2025}{1600} = \frac{81}{64}$$

$$\left(\frac{9}{8}\right)^n = \left(\frac{9}{8}\right)^2$$

$$n = 2$$

$$\therefore \quad \text{Time} = 2 \text{ years}$$

Example 64 :

The difference between C.I. and S.I. for 2 years at 10% per annum is ₹ 50. Find the sum.

Solution :

Suppose principal = ₹ 100

Time = 2 years; Rate = 10% per annum

Amount at C.I. = $P(1 + R)^n - P$

$$= ₹ \ 100\left(1 + \frac{10}{100}\right)^2 = ₹ \ 100 \times \frac{11}{10} \times \frac{11}{10} = ₹ \ 121$$

C.I. = ₹ 121 – ₹ 100 = ₹ 21

$$\text{S.I.} = ₹ \ \frac{100 \times 2 \times 10}{100} = ₹ \ 20$$

Difference between C.I. and S.I. = ₹ 21 – ₹ 20 = Re 1.

If the difference is Re. 1, then principal = ₹ 100

If the difference is ₹ 50, then principal = ₹ 100 × 50 = ₹ 5000

Example 65 :

The population of a place increased to 54000 in 2010, at the rate of 5% per annum

(i)   Find the population is 2008

(ii)   What would be its population in 2012.

Solution :

(i)   Population in 2010 = 54000

         Rate of increase = 5% per annum

         Suppose population in 2008 = P, Time = 2 years

$$\therefore \quad 54000 = P\left(1 + \frac{5}{100}\right)^2 = P\left(\frac{21}{20}\right)^2$$

or $P = 54000 \times \frac{21}{20} \times \frac{21}{20} = 48979.59$ (approximately)

         Hence the population in 2008 = 48980 (approximately)

(ii)   Suppose population in 2012 = A, Time = 2 years

$$\therefore \quad A = 54000\left(1 + \frac{5}{100}\right)^2 = 54000 \times \frac{21}{20} \times \frac{21}{20} = 59535$$

Hence population in 2012 = 59535

Example 66:

Find the difference between the simple interest and compound interest on ₹6000 for 2 years at 8% p.a. compounded annually.

Solution :

P = ₹ 6000, R = 8%, n = 2 years

$$SI = \frac{PRT}{100} = \frac{6000 \times 8 \times 2}{100} = ₹960$$

Now, $A = P\left(1 + \frac{R}{100}\right)^n = 6000\left(1 + \frac{8}{100}\right)^2 = 6000 \times 1.08 \times 1.08 = 6998.40$

∴ CI = A – P = 6998.40 – 6000 = ₹998.40

Thus, difference between compound interest and simple interest = 998.40 – 960 = ₹38.40

Example 67 :

Find the amount to be paid when sum of ₹8000 is invested for 1 year at 8% p.a. compounded quarterly.

Solution :

P = ₹ 8000 ; $R = \frac{1}{4} \times 8 = 2\%$ quarterly;   n = 4 × 1 = 4 conversion periods.

$A = P\left(1 + \frac{R}{100}\right)^n = 8000\left(1 + \frac{2}{100}\right)^4 = 8000(1.02)^4$

$= 8000 \times 1.02 \times 1.02 \times 1.02 \times 1.02 = ₹ 8659.46$

Example 68 :

Find the compound interest when a sum of ₹ 12000 is invested for $1\frac{1}{2}$ years at $6\frac{1}{2}$ % p.a. compounded annually.

Solution :

P = ₹ 12000 ; $n = 1\frac{1}{2}$ years $= \frac{3}{2}$; $R = 6\frac{1}{2}$ % p.a.

$A = 12000\left(1 + \frac{6\frac{1}{2}}{100}\right)^{\frac{3}{2}} = 12000\left(1 + \frac{13}{200}\right)^{1\frac{1}{2}}$

When the power is a fraction, we first calculate the amount for the whole part, i.e., 1 in this case, and using this amount as principal for the next half year, we calculate the simple interest.

Therefore, $A = 12000\left(1 + \frac{13}{200}\right) = 12000 \times \left(\frac{213}{200}\right) = ₹12780$

Thus,   ₹12780 is the principal for the next half year.

Now,   SI on ₹ 12780 for $\dfrac{1}{2}$ year at $6\dfrac{1}{2}\%$ = $12780 \times \dfrac{13}{200} \times \dfrac{1}{2}$ = ₹ 415.35

Interest for the 1st year = ₹ 12780 – 12000 = ₹ 780

Interest for the next $\dfrac{1}{2}$ year = ₹ 415.35

∴   Total compound interest = ₹ 780 + ₹ 415.35 = ₹ 1195.35

Example 69 :

The simple interest on a sum of money for 2 years at 5% per annum is ₹ 1200. What will be the compound interest on that sum at the same rate and for the same period ?

Solution :

S.I. = ₹ 1200;   R = 5% p.a.;   T = 2 years

$\text{S.I.} = \dfrac{PRT}{100}$ $\Rightarrow$ ₹ $1200 = \dfrac{P \times 5 \times 2}{100}$

$P = \dfrac{1200 \times 100}{5 \times 2}$ = ₹ 12000

Now,   P = ₹ 12000;   r = 5% p.a.;   n = 2 years

$$\text{C.I.} = P\left[\left(1+\dfrac{r}{100}\right)^n -1\right] = ₹\,12000\left[\left(1+\dfrac{5}{100}\right)^2 -1\right] = ₹\,12000\left[\left(1+\dfrac{1}{20}\right)^2 -1\right]$$

$$= ₹\,12000\left[\left(\dfrac{21}{20}\right)^2 -1\right] = ₹\,12000\left[\dfrac{441}{400} -1\right]$$

$$= ₹\,12000\left[\dfrac{41}{400}\right] = ₹\,1230$$

Compound interest on ₹ 12000 at 5% p.a. for 2 years is ₹ 1230.

Example 70 :

To clear a loan taken by Radhika for a period of 3 years at the rate of 10% p.a. compounded annually, she had to pay a sum of ₹ 79860 at the end of 3 years. Find the sum of money borrowed by her.

Solution :

Here A = ₹ 79860, r = 10% p.a., n = 3 years

$P = \dfrac{A}{\left(1+\dfrac{r}{100}\right)^n}$ we get,

$P = ₹\ \dfrac{79860}{\left(1+\dfrac{10}{100}\right)^3} = ₹\ \dfrac{79860}{\dfrac{11}{10}\times\dfrac{11}{10}\times\dfrac{11}{10}} = \dfrac{79860\times10\times10\times10}{11\times11\times11}$

Thus, the sum of money borrowed = ₹ 60000

Example 71 :
In how much time will ₹ 6000 amount to ₹ 6945.75 at 5% per annum compound interest ?
Solution :
Here   P = ₹ 6000;   A = ₹ 6945.75;   r = 5% p.a.
We know that

$$A = P\left(1+\frac{r}{100}\right)^n \qquad \Rightarrow \qquad 6945.75 = 6000\left(1+\frac{5}{100}\right)^n$$

or $\left(1+\frac{1}{20}\right)^n = \frac{694575}{600000}$ or $\left(\frac{21}{20}\right)^n = \frac{694575}{600000} = \frac{9261}{8000}$

$\therefore \qquad \left(\frac{21}{20}\right)^n = \left(\frac{21}{20}\right)^3$ or   n = 3

Hence, time = 3 yea₹

Example 72 :
At what sum the compound interest will become ₹ 615 at 5% p.a. for 2 years ?
Solution :
C.I. = 5% p.a.;   n = 2 years

$$C.I. = P\left[\left(1+\frac{r}{100}\right)^n -1\right] \qquad \Rightarrow \qquad ₹\,615 = P\left[\left(1+\frac{5}{100}\right)^2 -1\right]$$

$\Rightarrow \qquad ₹\,615 = P\left[\left(1+\frac{1}{20}\right)^2 -1\right] \qquad \Rightarrow \qquad ₹\,615 = P\left[\left(\frac{21}{20}\right)^2 -1\right]$

$\Rightarrow \qquad ₹\,615 = P\left[\frac{441-440}{400}\right] \qquad \Rightarrow \qquad P = \frac{Rs.615 \times 400}{41} = ₹\,6000$

Hence, the sum is ₹ 6000

Example 73 :

Find the compound interest on ₹ 20000 for $1\frac{1}{2}$ years at 10% per annum, interest being compounded half yearly.
Solution :

As the interest in this case is compounded half yearly, we convert time into half years, i.e., $1\frac{1}{2}$ years = 3

half years and take half the rate i.e., $\frac{10}{2}$ =5% per half year.
Thus,   P = ₹ 20000; r = 5%, per half year;   n = 3 half years

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

Amount = ₹ 20000 $\left(1+\frac{5}{100}\right)^3$ = ₹ 20000 $\times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20}$ = ₹ $\frac{46305}{2}$ = ₹ 23152.50

Compound interest = Amount – Principal = ₹ 23152.50 – ₹ 20000 = ₹ 3152.50

Example 74 :

An Air conditioner was purchased at ₹ 20000. Its value depreciates at the rate of 3% p.a. What would be the depreciation after 2 years ?

Solution :

As there is depreciation in the price of the Air-conditioner so we can say that this case is decrease or reduction in the standard form.

Price of the Air-condition = ₹ 20000 (we will treat this as amount)

In order to find the price after 2 year, we will calculate the amount.

$$\text{Amount} = P\left(1 - \frac{R}{100}\right)^T = ₹\ 20000\left(1 - \frac{3}{100}\right)^2 = ₹\ 20000 \times \frac{97}{100} \times \frac{97}{100} = ₹\ 18818$$

Thus, depreciation after two years = ₹ 200000 – 18818 = ₹ 1182

Example 75 :

Find the compound interest on ₹ 2000 for three years at 10% per annum. Also find the difference between C.I. and S.I. for that period.

Solution :

Principal for the first year = ₹ 2000, Rate = 10% per annum

$$\text{Interest for the first year} = ₹\ \left(\frac{2000 \times 10 \times 1}{100}\right) = ₹\ 200$$

∴   Amount at the end of the first year = ₹ (2000 + 200) = ₹ 2200

Principal for the second year = ₹ 2200

$$\text{Interest for the second year} = ₹\ \left(\frac{2200 \times 10 \times 1}{100}\right) = ₹\ 220$$

Again, Principal for the third year = ₹ 2420

$$\text{Interest for the third year} = ₹\ \left(\frac{2420 \times 10 \times 1}{100}\right) = ₹\ 242$$

∴   Amount at the end of the third year = ₹ (2420 + 242) = 2662

Hence, compound interest at the end of the third year = ₹ (2662 – 2000) = ₹ 662

$$\text{S.I. for three year} = \frac{P \times R \times T}{100} = ₹\ \left(\frac{2000 \times 10 \times 3}{100}\right) = ₹\ 600$$

Difference between C.I. and S.I. at the end of the third year = ₹ (662 – 600) = ₹ 62

Example 76 :

Kamala borrowed ₹ 26,400 from a bank to buy a scooter at a rate of 15% compounded annually. What amount will she pay at the end of 2 year and 4 months to clear the loan ?

Solution :

Principal for the first-year = ₹ 26,400

Rate = 15% per annum

Interest for the first year = ₹ $\dfrac{26,400 \times 15 \times 1}{100}$ = ₹ 3,960

Amount at the end of the year = ₹ (26,400 + 3,960) = ₹ 30,360

Principal for the 2nd year = ₹ 30,360

Interest for the 2nd year = ₹ $\dfrac{30,360 \times 15 \times 1}{100}$ = ₹ 4,554

Amount at the end of 2nd year = ₹ (30, 360 + 4,554) = ₹ 34,914

Interest for the last 4 months $\left(\dfrac{1}{3} \text{ year} \right)$ = ₹ $\dfrac{34,914 \times 15 \times 1}{3 \times 100}$ = ₹ 1745.70

Amount at the end of $2\dfrac{1}{3}$ years = ₹ (34,914 + 1745.70) = ₹ 36,659.70.

Hence, kamala has to pay ₹ 36,659.70 at the end of 2 years and 4 months.

Example 77 :

Arif took a loan of ₹ 80,000 from a bank. If the rate of interest is 10% per annum, find the difference in amounts he would be paying after $1\dfrac{1}{2}$ years, if the interest is

(i) compounded annually   (ii) compounded half-yeary

Solution :

Here, P = ₹ 80,000, R = 10% p.a., n = $1\dfrac{1}{2}$ year

(i) When the interest is compounded annually

Here n = $1\dfrac{1}{2}$ years, which is fractional. So, first find the amount for the whole part i.e., 1 year.

Then use this as principal to get simple interest for $\dfrac{1}{2}$ year more.

Thus,   A = $P\left(1 + \dfrac{R}{100} \right)^n$ = ₹ 80,000 $\left(1 + \dfrac{10}{100} \right)^1$ = ₹80,000 × $\dfrac{11}{10}$ = ₹ 88,000

Now,   this would act as principal for next $\dfrac{1}{2}$ year.

We find the SI on ₹ 88,000 for $\dfrac{1}{2}$ year.

S.I. = ₹ $\dfrac{88,000 \times 10 \times 1}{2 \times 100}$ = ₹ 4,400

Now,   Interest for first year = ₹ (88,000 – 80,000) = ₹ 8,000.

And,   Interest for next $\dfrac{1}{2}$ year = ₹ 4400

∴   Total compound interest = ₹ (8,000 + 4,400) = ₹ 12,400

∴   Amount at the end of $1\dfrac{1}{2}$ years = ₹ (80,000 + 12,400) = ₹ 92,400.

(ii)   When the interest is compounded half yearly.

Here $n = \dfrac{3}{2}$ years = 3 half-years

R = 10% p.a. = 5% per half year.

∴ $A = P\left(1 + \dfrac{R}{100}\right)^{n} = ₹\ 80,000 \left(1 + \dfrac{5}{100}\right)^{3}$

= ₹ 80,000 × $\dfrac{21}{20}$ × $\dfrac{21}{20}$ × $\dfrac{21}{20}$ = ₹ 92,610

∴   Required difference in amounts = ₹ (92,610 – 92,400) = ₹ 210

Example 78 :

The compound interest on a certain sum for 2 years is ₹ 40.80 and the simple interest is ₹ 40. Find the sum and rate per annum.

Solution :

Let the sum ₹ X

S.I. = $\dfrac{X \times R \times 2}{100}$ = 40

and   C.I. = $X\left(1 + \dfrac{R}{100}\right)^{2} - X = 40.80$

Here we have two equations and two variables X and R. On solving we have x = ₹ 500, R = 4%.

Example 79 :

   A certain sum of money at C.I. becomes to ₹ 811.25 in 2 years and to ₹ 843.65 in 3 years. Find the sum of money.

Solution :

Since $A = P\left[1 + \dfrac{R}{100}\right]^n$

$\Rightarrow$ $811.25 = P\left[1 + \dfrac{R}{100}\right]^2$ ..... (1)   and

$\Rightarrow$ $843.65 = P\left[1 + \dfrac{R}{100}\right]^3$ ..... (2)

On dividing (2) by (1), we get : $\dfrac{843.65}{811.25} = 1 + \dfrac{R}{100}$

$\Rightarrow$ $1.04 = 1 + \dfrac{R}{100}$ $\Rightarrow$ $R = 4$

Now, putting $R = 4$ into (1), we get

$811.25 = P\left[1 + \dfrac{4}{100}\right]^2$ $\Rightarrow$ $P = 750$

$\Rightarrow$ the sum of money is ₹ 750.

Example 80 :

   In how many years will ₹ 800 amount to ₹ 882 at 5% per annum compounded annually ?

Solution :

Here, $P = ₹\ 800$; $A = ₹882$; $r = 5\%$ p.a.

Let number of years be n.

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

$\Rightarrow$ $882 = 800\left(1 + \dfrac{5}{100}\right)^n = 800\left(1 + \dfrac{1}{20}\right)^n$

$\Rightarrow$ $\dfrac{882}{800} = \left(1 + \dfrac{1}{20}\right)^n$

$\Rightarrow$ $\dfrac{441}{400} = \left(\dfrac{21}{20}\right)^n$

or $\left(\dfrac{21}{20}\right)^2 = \left(\dfrac{21}{20}\right)^n$ $[\because 441 = 21^2$ and $400 = 20^2]$

Since the bases are same on both sides, hence $n = 2$

Since interest is compounded annually.

$\therefore$ Time $= 2$ years

Example 81 :

Determine the rate percent per annum if ₹ 25,000 amounts to 26,010 in 6 months, interest being compounded quarterly.

Solution :

Here, n = 2

Now, $A = P\left(1 + \dfrac{r}{100}\right)^n$, where r is the rate percent per quarter.

$\therefore \qquad 26010 = 25000\left(1 + \dfrac{r/4}{100}\right)^2$

or $\qquad \left(1 + \dfrac{r/4}{100}\right)^2 = \dfrac{26010}{25000} = \dfrac{2601}{2500} = \left(\dfrac{51}{50}\right)^2$

or $\qquad \dfrac{r/4}{100} = \dfrac{51}{50} - 1 = \dfrac{51-50}{50} = \dfrac{1}{50}$

or $\qquad r = \dfrac{4}{50} \times 100 = 8\%$

Hence, the required rate is 8% p.a.

Example 82 :

If the simple interest on a certain sum of money for 3 years at 5% is ₹ 150, find the corresponding CI.

Solution :

Whenever the relashionship between CI and SI is asked for 3 years of time, we use the formula :

$$S.I. = \dfrac{rt}{100\left[\left(1 + \dfrac{r}{100}\right)^t - 1\right]} \times C.I.$$

$$\Rightarrow \qquad 150 = \dfrac{5 \times 3}{100\left[\left(1 + \dfrac{5}{100}\right)^3 - 1\right]} \times C.I.$$

$$\therefore \qquad C.I. = \dfrac{150 \times 100\left[\dfrac{9261 - 8000}{8000}\right]}{5 \times 3}$$

$$= \dfrac{150 \times 100 \times 1261}{5 \times 3 \times 8000} = \dfrac{1261}{8} = 157.62$$

Example 83 :

Calculate the amount and the compound interest on ₹ 8000 in 2 years when the rate of interest for successive years is 5% and 6% respectively.

Solution :

Principal for the first year = ₹ 8000

Rate 'R' = 5% p.a.

Interest for the first year = $\dfrac{P \times R \times T}{100}$ = ₹ $\dfrac{8000 \times 5 \times 1}{100}$

Principal for the second year = ₹ 8000 + ₹ 400 = ₹ 8400

Rate 'R' = 6%

Interest for the second year $\dfrac{8400 \times 6 \times 1}{100}$ = ₹ 504

= Amount at the end of second year

= ₹ 8400 + ₹ 504 = ₹ 8904

Compound interest   = Amount at the end of second year – Principal(original)

= ₹ 8904 – ₹ 8000 = ₹ 904.

Example 84 :

(i)   **Convert $2\dfrac{1}{12}\%$ into a fraction.**

(ii)   **Convert $1\dfrac{11}{16}\%$ into a per cent.**

(iii) **Convert 21 : 80 into a per cent.**

(iv)   **Express 36% as a decimal.**

Solution :

(i) $2\dfrac{1}{12}\% = \dfrac{25}{12}\% = \dfrac{25}{12} \times \dfrac{1}{100} = \dfrac{1}{48}$

(ii) $1\dfrac{11}{16} = \dfrac{27}{16} = \left(\dfrac{27}{16} \times 100\right)\% = \dfrac{27 \times 25}{4}\% = \dfrac{675}{4}\% = 168.75\%$

(iii) $21 : 80 = \dfrac{21}{80} = \left(\dfrac{21}{80} \times 100\right) = \dfrac{105}{4}\% = 26.25\%$

(iv) $36\% = \dfrac{36}{100} = 0.36$

CONCEPT APPLICATION LEVEL - I   [NCERT Questions]

EXERCISE - 1

Q.1   **Find ratio of the following :**
       (a) Speed of a cycle 15 km per hour to the speed of scooter 30km per hour.
       (b) 5m to 10km
       (c) 50 paise to ₹ 5

Sol.   (a)   Speed of a cycle which is 15km per hour to the speed of scooter which is 30km per hour

           Ratio of the speed of cycle which is 15 km per hour to the speed of scooter which is 30km per hour

$$= 15 \text{ km per hour} : 30 \text{ km per hour } = 15 : 30 = \frac{15}{30} = \frac{1}{2} = 1 : 2$$

       (b)   5m to 10km

           $10\text{km} = 10 \times 1000\text{m} = 10000 \text{ m}$

∴   Ratio of 5m to 10km

$$= 5\text{m} : 10\text{km} = 5 \text{ m} : 10000 \text{ m } = 5 : 10000 = \frac{5}{10000} = \frac{1}{2000} = 1 : 2000$$

       (c)   50 paise to ₹ 5

           ₹ 5 = 5 × 100 = 500 paise

∴   Ratio of 50 paise to ₹ 5

$$= 50 \text{ paise} : ₹ 5 = 50 \text{ paise} : 500 \text{ paise} = 50 : 500 = \frac{50}{500} = \frac{1}{10} = 1 : 10$$

Q.2   **Convert the following ratios to percentages :**
       (a) 3 : 4   **(b) 2 : 3**

Sol.   (a) $3 : 4 \quad = \frac{3}{4} = \frac{3}{4} \times \frac{25}{25}$ [making denominator 100]

$$= \frac{75}{100} = 75\%$$

       (b) $2 : 3 \quad = \frac{2}{3} = \frac{2}{3} \times \frac{100}{100} = 66\frac{2}{3}\%$

Q.3   **72% of 25 students are good in mathematics. How many are not good in Mathematics.**

Sol.   Total number of students = 25,

       Students good in mathematics = 72%

∴   Students who are not good in mathematics = 100% – 72% = 28%

∴   Number of those students who are not good in mathematics = 28% of 25 = $\frac{28}{100} \times 25 = 7$

       Hence, 7 students are not good in mathematics.

Q.4   **A football team won 10 matches out of the total number of matches they played. If their win percentage was 40, then how many matches did they play in all ?**

Sol. $\because$ If 40 matches were won, then the total number of matches played = 100

        $\therefore$ If 1 match was won, then the total number of matches played = $\dfrac{100}{40}$

        $\therefore$ If 10 matches were won, then the total number of matches played = $\dfrac{100}{40} \times 10 = 25$

    Hence, they played 25 matches in all.

Q.5   **If Chameli had ₹ 600 left after spending 75% of her money, how much did she have in the beginning ?**

Sol.   Percentage of money left = 100% – 75% = 25%

        $\because$ If Chameli had ₹ 25 left, then the money she had in the beginning = 100

        $\therefore$ If Chameli had ₹ 1 left, then the money she had in the beginning = $\dfrac{100}{25}$

        $\therefore$ If Chameli has ₹ 600 left, then the money she had in the beginning = $\dfrac{100}{25} \times 600 = 2400$

    Hence, the money she had in the beginning was ₹ 2400.

Q.6   **If 60% people in a city like cricket, 30% like football and the remaining like other games then what per cent of the people like other games ? If the total number of people are 50 lakh, find the exact number who like each type of game.**

Sol.   People who like other games = 100% – (60% + 30%) = 100% – 90% = 10%

    total number of people = 50 lakh = 5000000

        $\therefore$ Number of people who like cricket = 60% of 5000000

$$= 5000000 \times \dfrac{60}{100} = 3000000 = 30 \text{ lakh}$$

        $\therefore$ Number of people who like football = 30% of 5000000

$$= 5000000 \times \dfrac{30}{100} = 1500000 = 15 \text{ lakh}$$

        $\therefore$ Number of people who like the other games   = 10% of 5000000

$$= 5000000 \times \dfrac{10}{100} = 500000 = 5 \text{ lakh}$$

EXERCISE - 2

Q.1 A man got a 10% increase in his salary. If his new salary is ₹ 1,54,000, find his original salary.

Sol. $100 + 10 = 110$

∵ If new salary is ₹ 110, then the original salary = ₹ 100

∴ If new salary is ₹ 1, then the original salary = ₹ $\dfrac{100}{110}$

∴ If new salary is ₹ 154000, then original salary = $\dfrac{100}{110} \times 154000 = $ ₹ 140000

Q.2 On Sunday 845 people went to the Zoo. On Monday only 169 people went. What is the percent decrease in the people visiting the Zoo on Monday.

Sol. $845 - 169 = 676$

Percent decrease in the number of people who went to zoo on Monday

$= \dfrac{\text{decrease}}{\text{original number}} \times 100\% = \dfrac{676}{845} \times 100\% = 80\%$

Q.3 A shopkeeper buys 80 articles for ₹ 2,400 and sells them for a profit of 16%. Find the selling price of one article.

Sol. CP of 80 articles = ₹ 2400

Profit = 16% of ₹ 2400 = ₹ $\dfrac{16}{100} \times 2400 = $ ₹ 384

∴ SP of 80 articles = CP + Profit = ₹ 2400 + ₹ 384 = ₹ 2784

∴ SP of 1 article = ₹ $\dfrac{2784}{80} = $ ₹ 34.80

Hence, the selling price of one article is ₹ 34.80

Q.4 The cost of an article was ₹15,500, ₹ 450 were spent on its repairs. If it is sold for a profit of 15%, find the selling price of the article.

Sol. CP of the article = ₹ 15,500 + ₹ 450 = ₹ 15,950

Profit = 15% of ₹ 15,950 = ₹ $\dfrac{15}{100} \times 15,950 = $ ₹ 2392.50

∴ SP of the article = CP + profit = ₹ 15,950 + ₹ 2392.50 = ₹ 18342.50

Hence, the selling price of the article is ₹ 18342.50.

Q.5 **A VCR and TV were bought for ₹ 8,000 each. The shopkeeper made a loss of 4% on the VCR and a profit of 8% on the TV. Find the gain or loss percent on the whole transaction.**

Sol. Combined

CP = ₹ 8000 + ₹ 8000 = ₹ 16,000

Loss of 4% on the VCR = 4% of ₹ 8,000 = ₹ $\dfrac{4}{100}$ × 8,000 = ₹ 320

∴　　SP of VCR = CP – Loss = ₹ 8000 – ₹ 320 = ₹ 7,680

Profit of 8% on the TV = 8% of ₹ 8,000 = ₹ $\dfrac{8}{100}$ × 8000 = ₹ 640

∴　　SP of TV = CP + Profit = ₹ 8000 + ₹ 640 = ₹ 8640

∴　　Combined SP = ₹ 7680 + ₹ 8640 = ₹ 16320

∴　　Gain on the whole transaction　= Combined SP – Combined CP

= ₹ 16320 – ₹ 16000 = ₹ 320

∴　　Gain percent on the whole transaction = $\dfrac{320}{16000}$ × 100 = 2%

Hence, the gain percent on the whole transaction is 2%.

Q.6 **During a sale, a shop offered a discount of 10% on the marked prices of all the items. What would a customer have to pay for a pair of jeans marked at ₹1450 and two shirts marked at ₹850 each?**

Sol. Marked price of a pair of jeans = ₹1450

∴　　Discount of 10% off = 10% of ₹1450 = ₹ $\dfrac{10}{100}$ × 1450 = ₹145

∴　　Sale price = Marked price – Discount = ₹1450 – ₹145 = ₹1305

Marked price of two shirts each of ₹850 = ₹850 × 2 = ₹1700

∴　　Discount of 10% off = 10% of ₹1700 = ₹ $\dfrac{10}{100}$ × 1700 = ₹170

∴　　Sale price = Marked price – Discount = ₹1700 – ₹170 = ₹1530

∴　　Total payment made by customer = ₹1305 + ₹1530 = ₹2835.

Hence, the customer will have to pay ₹2835 for a pair of jeans and two shirts.

Q.7 **A milkman sold two of his buffaloes for ₹20,000 each. On one he made a gain of 5% and on the other a loss of 10%. Find his overall gain or loss.**

[Hint: Find CP of each.]

Sol. Combined SP = ₹20,000 × 2 = ₹40,000

For one buffalo

SP of one buffalo = ₹20,000

Gain = 5%

∴   If the SP is ₹105, then CP = ₹100

∴   If the SP is ₹20,000, then CP = ₹$\dfrac{100}{105}$ × 20,000 = ₹$\dfrac{4,00,000}{21}$

Hence, the CP of one buffalo is ₹$\dfrac{4,00,000}{21}$

For one buffalo

SP of the other buffalo = ₹20,000

Loss = 10%

∴   If the SP is ₹90, then CP = ₹100

∴   If the SP is ₹20,000, then CP = ₹$\dfrac{100}{90}$ × 20,000 = ₹$\dfrac{2,00,000}{9}$

Hence, the CP of another buffalo is ₹$\dfrac{2,00,000}{9}$.

∴   Combined CP = ₹$\dfrac{400000}{21}$ + ₹$\dfrac{200000}{9}$ = ₹$\dfrac{2600000}{63}$

∴   Overall loss = combined CP – combined SP = ₹$\dfrac{2600000}{63}$ – ₹40,000

= ₹$\dfrac{80,000}{63}$ = ₹1269.84.

Q.8 **The price of a TV is ₹13,000. The sales tax charged on it is at the rate of 12%. Find the amount that Vinod will have to pay if he buys it.**

Sol. Price of TV = ₹13,000

Sales tax charged on it = 12% of ₹13,000 = ₹$\dfrac{12}{100}$ × 13,000 = ₹1560

∴   Sales price = price + sales tax = ₹13,000 + ₹1,560 = ₹14,560.

Q.9 **Arun bought a pair of skates at a sale where the discount given was 20%. If the amount he pays is ₹1600, find the marked price.**

Sol. $100 - 20 = 80$

∵   If amount paid is ₹80, then the marked price = ₹100

∴   If amount paid is ₹1, then the marked price = ₹$\dfrac{100}{80}$

∴   If amount paid is ₹1600, then the marked price = ₹$\dfrac{100}{80} \times 1600 = ₹2000$

Hence, the marked price of the pair of skates is ₹2000.

Q.10 **I purchased a hair-dryer for ₹5400 including 8% VAT. Find the price before VAT was added.**

Sol. ∵   When price including VAT is ₹108,
Original price = ₹100

∴   When price including VAT is ₹5400,

Original price = ₹ $\dfrac{100}{108} \times 5400 = ₹ 5000$

Hence, the price before VAT was added is ₹ 5000.

EXERCISE - 3

Q.1 **Calculated the amount and compound interest on.**

(a)   **₹10,800 for 3 years at $12\dfrac{1}{2}$ % per annum compounded annually**

(b)   **₹18,000 for $2\dfrac{1}{2}$ year at 10% per annum compounded annually**

(c)   **₹62,500 for $1\dfrac{1}{2}$ year at 8% per annum compounded half yearly**

(d)   **₹8,000 for 1 year at 9% per annum compounded half yearly**
         (You could use the year by year calculation using SI formula to verify)

(e)   **₹10,000 for 1 year at 8% per annum compounded half yearly**

Sol. **(a) By using year by year calculation**

SI on ₹10,800 at $12\dfrac{1}{2}$ % per annum for 1 year = $10,800 \times \dfrac{25}{2} \times \dfrac{1}{100} = ₹1,350$

∴   Amount at the end of 1st year = ₹10,800 + ₹1,350 (A = P + SI)
         = ₹12,150
         = Principal for 2nd year

SI on ₹12,150 at $12\frac{1}{2}$% per annum for 1 year $= 12{,}150 \times \dfrac{25}{2} \times \dfrac{1}{100} = $ ₹1,518.75

∴   Amount at the end of 2nd year = ₹12,150 + ₹ 1,518.75 = ₹13,668.75
        = Principal for 3rd year

SI on ₹13,668.75 at $12\frac{1}{2}$% per annum for 1 year

$= 13{,}668.75 \times \dfrac{25}{2} \times \dfrac{1}{100} = $ ₹1,708.59

Amount at the end of 3rd year = ₹13,668.75 + ₹1,708.59 = ₹15,377.34
this is the required amount
Now, CI = ₹15,377.34 – ₹10, 800 = ₹4,577.34
                OR
CI = ₹1,350 + ₹1,518.75 + ₹1,708.59 = ₹4,577.34

By using compound interest formula

P = ₹10, 800; $R = 12\frac{1}{2}$% per annum $= \dfrac{25}{2}$% per annum

n = 3 years

∴ $A = P\left(1 + \dfrac{R}{100}\right)^n$

$= ₹10{,}800\left(1 + \dfrac{25}{2 \times 100}\right)^3 = 10{,}800\left(1 + \dfrac{1}{8}\right)^3 = 10{,}800\left(\dfrac{9}{8}\right)^3 = 10{,}800 \times \dfrac{9}{8} \times \dfrac{9}{8} \times \dfrac{9}{8}$

$= ₹CI = A - P = $ ₹15,377.34 – ₹10,800 = ₹4,577.34

(b)   By using year by year calculation
        SI on ₹18,000 at 10% p.a. for 1 year

$= \dfrac{18{,}000 \times 10 \times 1}{100} = $ ₹1,800

∴   Amount at the end of 1st year
        = ₹18,000 + ₹1,800 = ₹19,800
        = Principal for 2nd year

SI on ₹19,800 at 10% p.a. for 1 year

$$= \frac{19,800 \times 10 \times 1}{100} = ₹1,980$$

∴   Amount at the end of 2nd year

= ₹19,800 + ₹1,980 = ₹21,780

= Principal for 3rd year

SI on ₹21, 780 at 10% p.a. for $\frac{1}{2}$ year

$$= \frac{21,780 \times 10 \times 1}{2 \times 100} = ₹1,089$$

∴   Amount at the end of $2\frac{1}{2}$ year

= ₹21,780 + ₹1,089

= ₹22, 869

this is the required amount.

Now CI = ₹22, 869 – ₹18,000 = ₹4, 869

By Using compound interest formula

P = ₹18,000;   R = 10% p.a.; n = 2 years

∴ $A = P\left(1 + \dfrac{R}{100}\right)^n$

$$= 18,000\left(1 + \frac{10}{100}\right)^2 = 18,000\left(1 + \frac{1}{10}\right)^2 = 18,000\left(\frac{11}{10}\right)^2 = 18,000 \times \frac{11}{10} \times \frac{11}{10} = ₹21,780$$

SI on ₹21,780 at 10% p.a. for $\frac{1}{2}$ year

$$= \frac{21,780 \times 10 \times 1}{2 \times 100} = ₹1,089$$

∴   Amount at the end of $2\frac{1}{2}$ years

= ₹21,780 + ₹1,089 = ₹22,869

∴   CI = A – P = ₹22,869 – ₹18,000 = ₹4,869

(c)   By using half year by half year calculation

SI on ₹62,500 at 8% p.a. for half year $= \dfrac{62,500 \times 8 \times 1}{2 \times 100} = ₹2,500$

∴   Amount at the end of 1st half year $= ₹62,500 + ₹2,500 = ₹65,00$
                                                    $=$ Principal for 2nd half year

SI on 65,000 at 8% p.a. for half year $= \dfrac{65,000 \times 8 \times 1}{2 \times 100} = ₹2,600$

∴   Amount at the end of 2nd half year $= ₹65,000 + ₹26,00 = ₹67,600$
                                                    $=$ Principal for 5rd half year

SI on ₹67600 at 8% p.a. for 1 half year $= \dfrac{67,600 \times 8 \times 1}{2 \times 100} = ₹2,704$

∴   Amount at the end of 3rd half year $= ₹67,600 + ₹2,704 = ₹70,304$
This is the required amount
Now, CI = ₹70,304 $-$ ₹62,500 = ₹7,804

By using compound interest formula
P = ₹62,500;   R = 8% p.a.;

$= \dfrac{1}{2} \times 8\%$ per half year $= 4\%$ per half year

n $= 1\dfrac{1}{2}$ year $= 1\dfrac{1}{2} \times 2$ half years $= 3$ half years

∴ $A = P\left(1 + \dfrac{R}{100}\right)^n$

$= 62,500\left(1 + \dfrac{4}{100}\right)^3 = 62,500\left(1 + \dfrac{1}{25}\right)^3 = 62,500\left(\dfrac{26}{25}\right)^3 = 62,500 \times \dfrac{26}{25} \times \dfrac{26}{25} \times \dfrac{26}{25}$

$= ₹70,304$
∴   CI $= A - P = ₹70,304 - ₹62,500 = ₹7804$

(c)   By using half year by half year calculation

SI on 8,000 at 9% p.a. for 1st half year $= \dfrac{8,000 \times 9 \times 1}{2 \times 100} = ₹360$

∴   Amount at the end of 1st half year $= ₹ 8,000 + ₹360 = ₹8,360$
          $=$ Principal for the 2nd half year

SI on ₹8,360 at 9% p.a. for 2nd half year $= \dfrac{8,360 \times 9 \times 1}{2 \times 100} = ₹376.20$

∴   Amount at the end of 2nd half year $= ₹ 8,360 + ₹376.20 = ₹8,736.20$
This is the required amount
Now, CI = ₹8,736.20 $-$ ₹8,000 = ₹736.20

By using compound interest formula

$P = ₹8,000; \quad R = 9\% \text{ p.a.}; \quad = \dfrac{9}{2} \% \text{ per half year}$

$n = 1 \text{ year} = 1 \times 2 \text{ half years} = 2 \text{ half years}$

$\therefore \quad A = P\left(1 + \dfrac{R}{100}\right)^n$

$= 8,000\left(1 + \dfrac{9}{2 \times 100}\right)^2 = 8,000\left(1 + \dfrac{9}{200}\right)^2 = 8,000\left(\dfrac{209}{200}\right)^2 = 8,000 \times \dfrac{209}{200} \times \dfrac{209}{200}$

$= ₹8,736.20$

$\therefore \quad CI = A - P = ₹8,736.20 \times ₹8,000 = ₹736.20$

(e)   By using half year by half year calculation

SI on ₹10,000 at 8% per annum for 1st half year $= \dfrac{10000 \times 8 \times 1}{2 \times 100} = ₹400$

$\therefore \quad$ Amount at the end of 1st half year $= ₹10,000 + ₹400 = ₹10,400$

$= ₹$ Principal for the 2nd half year

SI on ₹10,400 at 8% per annum for 2nd half year $= \dfrac{10,400 \times 8 \times 1}{2 \times 100} = ₹416$

Amount at the end of 2nd half year $= ₹10,400 + ₹416 = ₹10,816$

This is the required amount

Now, CI $= ₹10,816 - ₹10,000 = ₹816$

By using compound interest formula

$P = ₹10,000 ; \quad R = 8\% \text{ p.a.}$

$= \dfrac{8}{2} \% \text{ per half year} 124 = 4 \% \text{ per half year}$

$n = 1 \text{ year} = 1 \times 2 \text{ half years} = 2 \text{ half years}$

$\therefore \quad A = P\left(1 + \dfrac{R}{100}\right)^n$

$= 10000\left(1 + \dfrac{4}{100}\right)^2 = 10000\left(1 + \dfrac{1}{25}\right)^2 = 10000 \times \dfrac{26}{25} \times \dfrac{26}{25} = ₹10,816$

$\therefore \quad CI = A - P = ₹10,816 - ₹10,000 = ₹816$

Q.2 Kamala borrowed ₹26,400 from a Bank to buy a scooter at a rate of 15% p.a. compounded yearly, What amount will she pay at the end of 2 years and 4 months to clear the loan?
(Hint : Find A for 2 years if interest is compounded yearly and then find SI on the 2nd year amount for $\frac{4}{12}$ years)

Sol. P = ₹26, 400; R = 15% p.a.; n = 2 years

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

$$= 26,400\left(1 + \frac{15}{100}\right)^2 = 26,400\left(1 + \frac{3}{20}\right)^2 = 26,400\left(\frac{23}{20}\right)^2 = 26,400 \times \frac{23}{20} \times \frac{23}{20} = ₹34,914$$

S.I. on ₹34,914 at 15% p.a. for 4 months i.e., $\frac{4}{12}$ year, i.e., $\frac{1}{3}$ years $= \frac{34,914 \times 15 \times 1}{3 \times 100} = ₹1,745,70$

$\therefore \qquad$ Required amount $= ₹34,914 + ₹1,745.70 = ₹36,659.70$.

Hence the amount of that kavita will pay is ₹36,659.70

Q.3 Fabina borrows ₹12,500 at 12% per annum for 3 years at simple interest and Radha borrows the same amount for the same time period at 10% per annum, compounded annually. Who pays more interest and by how much?

Sol. For Fabina

SI on ₹12,500 at 12% p.a. for 3 years $= \frac{12,500 \times 12 \times 3}{100} = ₹4,500$

For Radha

$\qquad$ P = ₹12,500; R = 10% per annum; n = 3 years

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

$$= 12,500\left(1 + \frac{10}{100}\right)^3 = 12,500\left(1 + \frac{1}{10}\right)^3 = 12,500\left(\frac{11}{10}\right)^3 = 12,500 \times \frac{11}{10} \times \frac{11}{10} \times \frac{11}{10}$$

$$= ₹16,637.50$$

$\therefore \qquad$ CI = A – P = ₹16,637.50 – ₹12,500 = ₹4,137.50

Difference between CI and SI

$\qquad = ₹4,500 – ₹4,137.50 = ₹362.50$

Hence, Fabina pays more by ₹362.50.

Q.4 **I borrowed ₹12,000 from Jamshed at 6% per annum simple interest for 2 years. Had I borrowed this sum at 6% per annum compound interest, what excess amount would I have to pay?**

Sol. **At simple interest**

SI on ₹12,000 at 6% per annum for 2 years = $\dfrac{12,000 \times 6 \times 2}{100}$ = ₹1,440

At compound intersect

P = ₹12,00;   R = 6% per annum;   n = 2 years

∴ $A = P\left(1 + \dfrac{R}{100}\right)^n$

$= 12,000\left(1 + \dfrac{6}{100}\right)^2 = 12,000\left(1 + \dfrac{3}{50}\right)^2 = 12,000\left(\dfrac{53}{50}\right)^2$

$= 12,000 \times \dfrac{53}{50} \times \dfrac{53}{50}$ = ₹13,483.20

∴   CI = A – P

= ₹13,483.20 – ₹12,000 = ₹1,483.20

∴   Excess amount = ₹1,483.20 – ₹1,440 = ₹43.20

Hence, I would have to pay to him an excess amount of ₹43.20.

Q.5 **Vasudevan invested ₹60,000 at an interest rate of 12% per annum compounded half yearly. What amount would he get**

(i) after 6 months? (ii) after 1 year?

Sol. **(i)**   **After 6 months**

P = ₹60,000;   R = 12% per annum

$= \dfrac{1}{2} \times 12\%$ per half year = 6% per half year

n = 1 half year

∴ $A = P\left(1 + \dfrac{R}{100}\right)^n$

$= 60,000\left(1 + \dfrac{6}{100}\right)^1 = 60,000 \times \dfrac{106}{100}$

= ₹63,600

Hence, he would get ₹63,600 after 6 monts.

(ii)   After 1 year

P = ₹60,000

$R = 12\% \text{ per annum} = \dfrac{12}{2}\% \text{ per half year} = 6\% \text{ per half year}$

$n = 1 \text{ year}$

$= 1 \times 2 \text{ half year} = 2 \text{ half years}$

$\therefore \qquad A = P\left(1 + \dfrac{R}{100}\right)^{n}$

$= 60{,}000\left(1 + \dfrac{6}{100}\right)^{2} = 60{,}000\left(1 + \dfrac{3}{50}\right)^{2}$

$= 60{,}000\left(\dfrac{53}{50}\right)^{2} = 60{,}000 \times \dfrac{53}{50} \times \dfrac{53}{50} = ₹67{,}416$

Hence, he would get ₹67,416 after 1 year.

Q.6   Arif took a loan of ₹80,000 from bank. If the rate of interest is 10% per annum find the difference in amounts he would paying after $1\dfrac{1}{2}$ years if the interest is

(i)   compounded annually   (ii)   compounded half yearly.

Sol.   (i)   Compounded annually

P = ₹80,000;   R = 10% per annum;   n = 1 year

$\therefore \qquad A = p\left(1 + \dfrac{R}{100}\right)^{n}$

$= 80{,}000\left(1 + \dfrac{10}{100}\right)^{1} = 80{,}000\left(1 + \dfrac{1}{10}\right) = 80{,}000 \times \dfrac{11}{10} = ₹88{,}000$

SI on ₹88,000 at 10% per annum for $\dfrac{1}{2}$ year

$= \dfrac{88{,}000 \times 10 \times 1}{2 \times 100} = ₹\, 4{,}4000$

(ii)   Compounded half yearly

P $= ₹80,000$

R $= 10\%$ per annum

$= \dfrac{10}{2}$ % per half year $= 5\%$ per half year

n $= 1\dfrac{1}{2}$ years $= 1\dfrac{1}{2} \times 2$ half years $= 3$ half years

∴ $A = P\left(1+\dfrac{R}{100}\right)^{n}$

$= 80,000\left(1+\dfrac{5}{100}\right)^{3} = 80,000\left(1+\dfrac{1}{20}\right)^{3} = 80,000 \times \dfrac{21}{20}\times\dfrac{21}{20}\times\dfrac{21}{20} = ₹92,610$

This is the required amount.

Difference in amounts $= 92,610 – ₹\ 92,400 = 210$.

Hence, the difference in amounts is $₹210$.

Q.7   Maria invested ₹8,000 in a business. She would be paid interest at rate of 5% per annum compounded annually. Find

(i) the amount credited aginst her name at the end of the second year.

(ii) the interest for the 3rd year.

Sol.   (i) $P = ₹8,000$; $R = 5\%$ per annum; $n = 2$ years

∴ $A = P\left(1+\dfrac{R}{100}\right)^{n}$

$= 8,000\left(1+\dfrac{5}{100}\right)^{2} = 8,000\left(1+\dfrac{1}{20}\right)^{2} = 8,000\left(1+\dfrac{21}{20}\right)^{2} = 8,000 \times \dfrac{21}{20}\times\dfrac{21}{20} = ₹\ 8,820$

Hence, the amount credited against his name at the end of second year is $₹8820$.

(ii) $P = ₹8,820$

R $= 5\%$ per annum

n $= 1$ year

$A = P\left(1+\dfrac{R}{100}\right)^{n} = 8,820\left(1+\dfrac{5}{100}\right)^{1} = 8,820\left(1+\dfrac{1}{20}\right) = 8,820 \times \dfrac{21}{20} = ₹9,261$

∴   Interest for the 3rd year $= A – P = ₹9,261 – ₹8,820 = ₹441$

Hence, the interest for the 3rd year is $₹\ 441$.

Q.8   **Find the amount and the compound interest on ₹ 10,000 for $1\dfrac{1}{2}$ years at 10% per annum, compounded half yearly. Would this interest be more than the interest he would get if it was compounded annually ?**

Sol.   When compounded half yearly

P = ₹ 10,000

$R = 10\%$ per half year $= \dfrac{10}{2}$ % per half year $= 5\%$ per half year

$n = 1\dfrac{1}{2}$ years $= \dfrac{3}{2} \times 2$ half years $= 3$ half years

$\therefore \qquad A = P\left(1 + \dfrac{R}{100}\right)^{n}$

$= 10{,}000\left(1 + \dfrac{5}{100}\right)^{3} = 10{,}000\left(1 + \dfrac{1}{20}\right)^{3} = 10{,}000\left(\dfrac{21}{20}\right)^{3} = 10{,}000 \times \dfrac{21}{20} \times \dfrac{21}{20} \times \dfrac{21}{20}$

$= ₹11{,}576.25$

This is the required amount.

Now, Cl $= A - P = ₹11{,}576.25 - ₹10{,}000 = ₹1{,}576.25$

This is the required Cl.

When compounded annually

P = ₹10,000;   R = 10% per annum;   n = 1 year

$\therefore \qquad A = P\left(1 + \dfrac{R}{100}\right)^{n} = 10{,}000\left(1 + \dfrac{10}{100}\right)^{1} = 10{,}000\left(1 + \dfrac{1}{10}\right) = 10{,}000 \times \dfrac{11}{10} = ₹11{,}000$

$= $ Principal for next $\dfrac{1}{2}$ year

$\therefore \qquad$ Interest for first year $= A - P$

$= ₹11{,}000 - ₹10{,}000 = ₹1{,}000$

SI on ₹11,000 at 10% per annum for $\dfrac{1}{2}$ year $= \dfrac{11{,}000 \times 10 \times 1}{2 \times 100} = ₹550$

$\therefore \qquad$ Total compound interest

$= ₹1{,}000 + ₹550 = ₹1550$

Hence, the interest when compounded half yearly would be more than the interest when compounded annually.

Q.9. Find the amount which Ram will get on ₹4,096, if he gave it for 18 months at $22\frac{1}{2}\%$ per annum, interest being compounded half yearly.

Sol.   P = ₹4,096

$$R = 22\frac{1}{2}\% \text{ per annum} = \frac{25}{2}\% \text{ per annum} = \frac{1}{2}\times\frac{25}{2}\% \text{ per half year} = \frac{25}{4}\% \text{ per half year}$$

$$n = 18 \text{ months} = \frac{18}{6} \text{ half years} = 3 \text{ half years}$$

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

$$= 4{,}096\left(1+\frac{25}{4\times100}\right)^{3} \qquad = 4{,}096\left(1+\frac{1}{16}\right)^{3}$$

$$= 4{,}096\left(\frac{17}{16}\right)^{3} = 4{,}096 \times \frac{17}{16}\times\frac{17}{16}\times\frac{17}{16} = ₹4{,}913$$

Hence, the required amount is ₹4,913.

Q.10 The population of a place increased to 54,000 in 2003 at a rate of 5% per annum.
      (i) find the population in 2001
      (ii) what would be its population in 2005 ?

Sol.   (i) Let the population in 2001 be P.

         R = 5% p.a.;   n = 2 years

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^{n} = P\left(1+\frac{5}{100}\right)^{2} = P\left(1+\frac{1}{20}\right)^{2} = P\left(\frac{21}{20}\right)^{2}$$

According to the question,

$$P\left(\frac{21}{20}\right)^{2} = 54{,}000$$

$$\Rightarrow \quad P = 54{,}000\left(\frac{20}{21}\right)^{2}$$

$$= 54{,}000\times\frac{20}{21}\times\frac{20}{21} = 48{,}980 \text{ (approx.)}$$

Hence, the population in 2001 was 48,980 (approx.)

(ii)   P = 54,000;   R = 5% p.a.;   n = 2 years

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

$$= 54,000\left(1 + \frac{5}{100}\right)^2 = 54,000\left(1 + \frac{1}{20}\right)^2$$

$$= 54,000\left(\frac{21}{20}\right)^2 = 54,000 \times \frac{21}{20} \times \frac{21}{20} = 59,535$$

Hence, the population in 2005 would be 59,535.

Q.11 **In a Laboratory, the count of bacteria in a certain experiment was increasing at the rate of 2.5% per hour. Find the bacteria at the end of 2 hours, if the count was initially 5,06,000.**

Sol.   P = 5,06,000;   R = 2.5% per hour;   n = 2 hours

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

$$= 5,06,000\left(1 + \frac{2.5}{100}\right)^2 = 5,06,000\left(1 + \frac{1}{40}\right)^2$$

$$= 5,06,000\left(\frac{41}{40}\right)^2 = 5,06,000 \times \frac{41}{40} \times \frac{41}{40}$$

$$= 5,31,616 \text{ (approx.)}$$

Hence, the count of bacteria at the end of 2 hours is 5,31,616 (approx.).

Q.12 **A scooter was bought at ₹42,000. Its value depreciated at the rate of 8% per annum. Find its value after one year.**

Sol.   P = ₹2,000;   R = 8% per annum;   n = 1 year

$$\therefore \quad A = P\left(1 - \frac{R}{100}\right)^n$$

$$= 42,000\left(1 - \frac{8}{100}\right)^1 = 42,000\left(1 - \frac{2}{25}\right)$$

$$= 42,000 \times \frac{23}{25} = ₹38,640$$

Hence, its value after 1 year is ₹38,640.

TRY THESE

Q.1 **In a primary school, the parents were asked about the number of hours they spend per day in helping their children to do homework. There were 90 parents who helped for $\frac{1}{2}$ hour to $1\frac{1}{2}$ hours the distribution of parents according to the time for which, they said they helped is given in the adjoining figure; 20% helped for more than $1\frac{1}{2}$ hours per day; 30% helped for $\frac{1}{2}$ hour to $1\frac{1}{2}$ hours; 50% did not help at all.**

Using this, answer the following :
(i) How many parents were surveyed ?
(ii) How many said that they did not help ?
(iii) How many said that they helped for more than $1\frac{1}{2}$ hours?
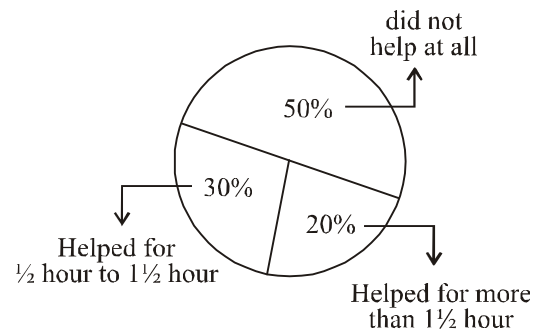
Sol. (i) $\because$ If 30 parents helped for $\frac{1}{2}$ hour to $1\frac{1}{2}$ hours, then the number of parents = 100

$\therefore$ If 1 parent helped for $\frac{1}{2}$ hour to $1\frac{1}{2}$ hours, then the number of parents = $\frac{100}{30}$

$\therefore$ If 90 parents helped for $\frac{1}{2}$ hour to $1\frac{1}{2}$ hours, then the number of parents = $\frac{100}{30} \times 90 = 300$

Hence, 300 parents were surveyed.

(ii) Number of those parents who said that they did not help = 50% of 300 = $300 \times \frac{50}{100} = 150$

Hence, 150 parents said that they did not help.

(iii) Number of those parents who said that they helped for more than $1\frac{1}{2}$ hours = 20% of 300

$= 300 \times \frac{20}{100} = 60$

Hence, 60 parents said that they helped for more than $1\frac{1}{2}$ hours

Q.2   **A shop gives 20% discount. What would the sale price of each of these be ?**

  (a)   **a dress marked at ₹ 120**

  (b)   **A pair of shoes marked at ₹ 750**

  (c)   **A bag marked at ₹ 250**

Sol.   (a)   a dress marked at ₹ 120

      Marked price = ₹ 120

      Discount = 20% of ₹ 120 = ₹ $\dfrac{20}{100} \times 120$ = ₹ 24

  ∴   Sale price = Marked price – Discount = ₹ 120 – 24 = ₹ 96

  (b)   A pair of shoes marked at ₹ 750

      Marked price = ₹ 750

      Discount = 20% of ₹ 750 = ₹ $\dfrac{20}{100} \times 750$ = ₹ 150

  ∴   Sale price = Marked price – Discount = ₹ 750 – 150 = ₹ 600

  (c)   A bag marked at ₹ 250

      Marked price = ₹ 250

      Discount = 20% of ₹ 250 = ₹ $\dfrac{20}{100} \times 250$ = ₹ 50

  ∴   Sale price = Marked price – Discount = ₹ 250 – 50 = ₹ 200

Q.3   **A table marked at ₹ 15,000 is available for Rs 14,400. Find the discount given and the discount percent.**

Sol.   Marked price = ₹ 15,000; Sale price = ₹ 14,400

  ∴   Discount given = Marked price – Sale price = ₹ 15,000 – Rs, 14,400 = ₹ 600

  ∴   Discount per cent = $\left(\dfrac{600}{15000} \times 100 \right) \% = 4\%$

Q.4   **An almirah is sold at Rs, 5,225 after allowing a discount of 5%. Find its marked price.**

Sol.   Let the marked price be ₹ x

  ∴   Discount = 5% of ₹ x = ₹ $\dfrac{5}{100} \times x$ = ₹ $\dfrac{x}{20}$

  ∴   Sale price = Marked price – Discount = ₹ x – ₹ $\dfrac{x}{20}$ = ₹ $\dfrac{19x}{20}$

According to the question,

  $\dfrac{19x}{20} = 5225 \quad \Rightarrow \quad x = \dfrac{5225 \times 20}{19} = 5500$

Hence, the marked price of the almirah is ₹ 5500

Q.5   **Find selling price (SP) if a profit of 5% is made on**

   (a)   **a cycle of ₹ 700 with ₹ 50 as overhead charges.**

   (b)   **a lawn mower bought at ₹ 1150 with ₹ 12 transportation charges**

   (c)   **a fan bought for ₹ 560 and expenses of ₹ 40 made on its repairs**

Sol.   **(a)**   CP = ₹ 700 + ₹ 50 = ₹ 750

      Profit = 5% of ₹ 750

$$= ₹ \ \frac{5}{100} \times 750 = ₹ \ 37.50$$

$\therefore$ SP   = CP + Profit

        = ₹ 750 + ₹ 37.50 = ₹ 787.50

   (b)   CP = ₹ 1150 + ₹ 50 = ₹ 1200

      Profit   = 5% of ₹ 1200 = ₹ $\frac{5}{100}$ × 1200 = ₹ 60

$\therefore$ SP = CP + Profit

      = ₹ 1200 + ₹ 60 = ₹ 1260

   (c)   CP = ₹ 560 + ₹ 40 = ₹ 600

      Profit   = 5% of ₹ 600 = ₹ $\frac{5}{100}$ × 600 = ₹ 30

$\therefore$ SP = CP + Profit = ₹ 600 + ₹ 30 = ₹ 630

Q.6   **A shopkeeper bought two TV sets at ₹ 10,000 each. He sold one at a profit 10% and the other at a loss of 10%. Find whether he made an overall profit or loss.**

Sol.   Combined CP = ₹ 10,000 + ₹ 10,000 = ₹ 20,000

Profit on one TV = 10% of ₹ 10,000 = ₹ $\frac{10}{100}$ × 10,000 = ₹ 1000

$\therefore$ SP of one TV = CP + Profit = ₹ 10000 + ₹ 1000 = ₹ 11000

Loss on the other TV

$$= 10\% \ of ₹ \ 10,000 = ₹ \ \frac{10}{100} \times 10,000 = ₹ \ 1000$$

$\therefore$ SP of the other TV = CP – Loss = ₹ 10000 – ₹ 1000 = ₹ 9000

$\therefore$ Combined SP = ₹ 11000 + ₹ 9000 = ₹ 20000

$\because$ Combined CP = Combined SP

$\therefore$ He made no overall profit or loss.

Q.7   **Find the buying price of each of the following when 5% ST is added on the purchase of**

    (a)   **A towel at ₹ 50**

    (b)   **Two bars of soap at ₹ 35 each**

    (c)   **5kg of flour at ₹ 15 per kg**

Sol   (a)   ∵ Cost of towel = ₹ 50

        Rate of ST = ₹ 5%

    ∴   ST = 5% of ₹ 50 = ₹ $\frac{5}{100} \times 50$ = ₹ 2.50

    ∴   Buying price of the towel = ₹ 50 + ₹ 2.50 = ₹ 52.50

    (b)   cost of two bars of soap = ₹ 35 × 2 = ₹ 70

        Rate of ST = 5%

    ∴   ST = 5% of ₹ 70 = ₹ $\frac{5}{100} \times 70$ = ₹ 3.50

    ∴   Buying price of two bars of soap = ₹ 70 + ₹ 3.50 = ₹ 73.50

    (c)   Cost of 5kg of flour = ₹ 15 × 5 = ₹ 75

        Rate of ST = 5%

    ∴   ST = 5% of ₹ 75 = ₹ $\frac{5}{100} \times 75$ = ₹ 3.75

    ∴   Buying price of 5kg of flour = ₹ 75 + ₹ 3.75 = ₹ 78.75

Q.8   **If 8% VAT is included in the prices, find the original price of**

    (a)   **A TV bought for ₹ 13,500**

    (b)   **A shampoo bottle bought for ₹ 180**

Sol.   (a) ∵   When price including VAT is ₹ 108,

        Original price = ₹ 100

    ∴   When price including VAT of a TV is ₹ 13500

        Original price = ₹ $\frac{100}{108} \times 13500$ = ₹ 12500

        Hence, the original price of the TV is ₹ 12500

    (b)   ∵ When price including VAT is ₹ 108

        Original price = ₹ 100

    ∴   When price including VAT of a shampoo bottle is ₹ 180,

        Original price = ₹ $\frac{100}{108} \times 180$ = ₹ $\frac{500}{3}$ = ₹ 166.67

        Hence, the original price of the shampoo bottle is ₹ 166.67.

Q.9 **Two times a number is a 100% increase in the number. If we take half the number what would be the decrease in per cent ?**

Sol. Decrease percent = $\dfrac{\text{new number}}{\text{original number}} \times 100\%$

$$= \dfrac{\dfrac{1}{2}\,\text{original number}}{\text{original number}} \times 100\% = 50\%$$

Q.10 **By what per cent is ₹ 2,000 less than ₹ 2,400 ? Is it the same as the per cent by which ₹ 2,400 is more than ₹ 2,000 ?**

Sol. $2400 - 2000 = 400$

Decrease percent = $\dfrac{\text{decrease}}{\text{original value}} \times 100\% = \dfrac{400}{2400} \times 100\% = 16\dfrac{2}{3}\%$

Increase percent = $\dfrac{\text{decrease}}{\text{original value}} \times 100\% = \dfrac{400}{2000} \times 100\% = 20\%$

Hence, the percent by which ₹ 2000 is less than ₹ 2400 is not the same as the percent by which ₹ 2400 is more than ₹ 2000.

Q.11 **Find interest and amount to be paid on ₹15,000 at 5% per annum after 2 years.**

Sol. ∴　　Interest on ₹100 for 1 year = ₹5.

∴　　Interest of ₹15000 for 1 year = ₹$\dfrac{5}{100} \times 15000$

∴　　Interest on ₹15000 for 2 years = ₹$\dfrac{5 \times 15000 \times 2}{100}$ = ₹1500

∴　　Amount = Principal + Interest = ₹15,000 + ₹1,500 = ₹16,500.

Q.12 **Find CI on a sum of ₹8000 for 2 years at 5% per annum compounded annually.**

Sol. Here, P = ₹ 8000;　　R = 5% p.a.;　　n = 2 years

∴　　　$A = P\left(1 + \dfrac{R}{100}\right)^n$

$$= 8000\left(1 + \dfrac{5}{100}\right)^2 = 8000\left(1 + \dfrac{1}{20}\right)^2 = 8000\left(\dfrac{21}{20}\right)^2 = 8000 \times \dfrac{21}{20} \times \dfrac{21}{20} = ₹\,8820$$

∴　　　CI = A − P = ₹8820 − ₹8000 = ₹820

Find the time period and rate for each :

Q.13 **A sum taken for $1\dfrac{1}{2}$ years at 8% per annum is compounded half-yearly.**

Sol. Time period = 3 half years

$$\text{Rate} = \frac{1}{2} \times 8\% = 4\%. \text{ half years}$$

Q.14 **A sum taken for 2 years at 4% per annum compounded half yearly.**
Sol. Time period = 4 half years

$$\text{Rate} = \frac{1}{2} \times 4\% = 2\% \text{ half yearly.}$$

Q.15 **A sum is taken for one year at 16% p.a. If interest is compounded after every three months, how many times interest will be charged in one year.**
Sol. 1 year = 4 quarters
Interest will be charged 4 times in one year.

Find the amout to be paid
Q.16 **At the end of 2 years on ₹ 2,400 at 5% per annum compounded annually.**
Sol. P = ₹2400;   R = 5% per annum;   n = 2 years

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

$$= 2400\left(1 + \frac{5}{100}\right)^2 = 2400\left(1 + \frac{1}{20}\right)^2 = 2400\left(\frac{21}{20}\right)^2 = 2400 \times \frac{21}{20} \times \frac{21}{20} = ₹2646$$

Q.17 **At the end of 1 year on ₹ 1800 at 8% per annum compounded quarterly.**
Sol. P = ₹1800
R = 8% per annum

$$= \frac{1}{4} \times 8\% \text{ quarterly}$$

$$= 2\% \text{ quarterly}$$

n = 1 year
    = 4 quarters

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

$$= 1800\left(1 + \frac{2}{100}\right)^4 = 1800\left(1 + \frac{1}{50}\right)^4 = 1800\left(\frac{51}{50}\right)^4 = 1800 \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50}$$

$$= ₹1948.38$$

Q.18   **A machinary worth ₹10,500 depreciated by 5%. Find its value after one year.**

Sol.   P = ₹10,500;   R = 5% per annum;   n = 1 year

$$\therefore \quad A = P\left(1 - \frac{R}{100}\right)^n$$

$$= 10,500\left(1 - \frac{5}{100}\right)^1 = 10,500\left(1 - \frac{1}{20}\right) = 10,500 \times \frac{19}{20} = 9,975$$

Hence value after 1 year is ₹9975.

Q.19   **Find the population of a city after 2 years, which is at present 12 lakh, if the rate of increase is 4%.**

Sol.   P = 12,00,000; R = 4% per annum; n = 2 years

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

$$= 12,00,000\left(1 + \frac{4}{100}\right)^2 = 12,00,000\left(1 + \frac{1}{25}\right)^2$$

$$= 12,00,000\left(\frac{26}{25}\right)^2 = 12,00,000 \times \frac{26}{25} \times \frac{26}{25}$$

$$= 12,97\,920$$

Hence, the population of the city after 2 years is 1297920.

CONCEPT APPLICATION LEVEL - II

SECTION -A

● **FILL IN THE BLANKS**

Q.1   The word percent means _____.

Q.2   _____% of 50 is 19.

Q.3   _____ is calculated on the sale value by applying the rate of tax as applicable.

Q.4   _____ is the price at which the article is purchased.

Q.5   _____ price is the price at which the article is sold.

Q.6   _____ = selling price – cost price.

Q.7   _____ = cost price – selling price

Q.8   Profit _____ $= \left(\dfrac{Profit \times 100}{Cost\ price} \right)\%$

Q.9   Loss _____ $= \left(\dfrac{Loss \times 100}{Cost\ price} \right)\%$

Q.10   Real cost = cost price + _____ .

Q.11   The money borrowed or lent is called the _____.

Q.12   The sum of the principal and the interest is called the _____.

Q.13   _____ is the interest paid on ₹ 100 for a specified period.

Q.14   The difference of tax recovered on sale vale and paid on purchase value is deposited to government as _____.

Q.15   Find the simple interest on ₹ 500 at 10% per annum for 3 years _____.

Q.16   In case of simple interest principal remains the same throughout the loan period. Is it ture ? _____.

Q.17   Write down the formula for calculating the amount of ₹ P in n years at r% per annum compounded annually. _____.

Q.18   What is the relationship among amount, principal and S.I.? _____.

Q.19   What is the difference between the compound interest compounded annually and the simple interest on ₹ 100 at 5% per annum for 1 year. _____.

Q.20 $P\left[\left(1 + \dfrac{r}{100} \right)^n - 1 \right] =$ _____.

Q.21   In case of C.I., the principal increases every year. Does the rate of interest also vary in the case of C.I. ? _____.

Q.22   Express 5 paise per rupee per annum as per cent per annum _____.

Q.23   Express 0.5% per month as per cent per annum. _____.

Q.24   How many quarters are there in $1\dfrac{1}{2}$ years ? _____.

Q.25   _____ is always calculated on the marked price.

Q.26 In $P\left[1+\dfrac{R}{100}\right]^n$, R stands for _____.

Q.27 Cost price + profit gives _____.

Q.28 Comparison of two quantities by division is called _____.

Q.29 The principal + _____ gives amount.

Q.30 Rate of interest is usally specified as r% _____.

Q.31 Selling price-profit gives _____.

SECTION -B
- **MULTIPLE CHOICE QUESTIONS**

Q.1 Find the ratio of 70 P to ₹14.

(A) 1 : 20   (B) 20 : 1   (C) 1 : 5   (D) $55\dfrac{2}{3}$

Q.2 Convert 2 : 3 to percent.

(A) $66\dfrac{3}{2}$ (B) $66\dfrac{2}{3}$ (C) $55\dfrac{3}{2}$ (D) $55\dfrac{2}{3}$

Q.3 A man gets 10% increase in his salary. If his new salary is ₹1,15,500, find his original salary.

(A) 10,500   (B) 1,05,000   (C) 2,05,000   (D) 2,32,700

Q.4 Atul is earning 10% more than his brother Amit. Find by what percent Amit's income is less than Atul's income.

(A) $9\dfrac{1}{11}$ (B) $11\dfrac{1}{11}$ (C) $9\dfrac{11}{17}$ (D) $9\dfrac{12}{17}$

Q.5 A fruit seller purchased some fruits. Later he found that 15% of the fruits were rotten. He sold 60% of the remaining fruits. He is now left with 34 fruits. Find the total fruits purchased by him.

(A) 200   (B) 250   (C) 100   (D) 300

Q.6 Kapil purchased an old car for ₹114400 and spent ₹5600 on its repair. He then sold the car for ₹150000. Find his gain percent in this transaction.

(A) 12.5%   (B) 25%   (C) 28%   (D) 30%

Q.7 A shopkeeper bought 100 bulbs for ₹12 each. He found 10 bulbs to be fused and sold the remaining bulbs so as to gain 5% on whole transaction. At what price should he sell each bulb?

(A) 17   (B) 14   (C) 15   (D) 13

Q.8 A shopkeeper sold an article for ₹720 at a loss of 10%. At what price should he shell it so as to gain 5%?

(A) 870   (B) 900   (C) 850   (D) 840

Q.9 Raju sold two fans for ₹990 each. On selling one fan, he had a gain of 10% and on selling other fan, he had a loss of 10%. Find his gain or loss percent in the whole transaction.

(A) gain 1%   (B) gain 10%   (C) loss 1%   (D) loss 10%

Q.10   A furniture seller is giving a discount of 14% on the sofa set. The marked price of the sofa set is ₹22000. Find the selling price of the sofa set after discount.
(A) 20,000   (B) 18,000   (C) 17,500   (D) 18,920

Q.11   To promote his sale, a shopkeeper charges ₹15488 for a T.V. set with marked price of ₹17600. Find the rate of discount given by him to the customer.
(A) 12%   (B) 12.5%   (C) 14%   (D) 16%

Q.12   An article with marked price ₹1500 was sold to a customer for ₹1200. Find the rate of discount allowed on an article.
(A) 20%   (B) 30%   (C) 40%   (D) 60%

Q.13   A radio was sold for ₹323 after allowing a discount of 15% on the marked price. Find the marked price of the radio.
(A) ₹400   (B) ₹450   (C) ₹350   (D) ₹380

Q.14   Renu Chauhan deposited a sum of ₹12500 in a bank for 3 years. If bank pays compound interest at the rate of 6% per annum, what amount will she get at the end of 3 years?
(A) 12,000.00   (B) 138210.50   (C) 14887.70   (D)12500.50

Q.15   Rajesh borrowed ₹100000 for 3 years from his friend at 7% compound annually. How much money will he pay to his friend at the end of 3 years?
(A) 122504.30   (B) 120000.00   (C) 11,0500.75   (D) 16,0000.50

Q.16   Mohan lent ₹1,60,000 to his friend for 2 years 3 months at the rate of 8% p.a. compounded annually. How much money will Mohan get as compound interest at the end of 2 years 3 months?
(A) 30350.56   (B) 30570.72   (C) 30356.48   (D) 30,000.00

Q.17   Find the difference between compound interest and simple interest on a sum of ₹25000 for 3 years at the rate of 4% per annum.
(A) 2000   (B) 1000   (C) 1500   (D) 3000

Q.18   Veena borrowed ₹5,12,000 from a bank for 1 year 6 months. If the bank charges 2½% per annum, compounded half-yearly, what amount will she have to pay after the given time period? Also, find the interest paid by her.
(A) 20,144   (B) 19,441   (C) 19,581   (D) 16,772

Q.19   Out of her total income, Mrs Sharma spends 20% on house rent and 70% of the rest on household expenses. If she saves ₹1800, what is her total income?
(A) 7500   (B) 8500   (C) 9600   (D) 9000

Q.20   On Sunday 845 people went to the zoo. On Monday only 169 people went. What is the per cent decrease in the people visiting the zoo on Monday?
(A) 90%   (B) 80%   (C) 60%   (D) 70%

Q.21   The cost of an item is ₹44. This is 10% more than its cost in the previous year. Find the cost of the item in the previous year.
(A) 30   (B) 40   (C) 50   (D) 60

Q.22   A mixture of milk and water contains 7 parts of milk and 3 parts of water. Find the percentage of milk and water in the mixture.

(A) 25% &75%   (B) 60% & 40%   (C) 30% & 70%   (D) 70% 30%

Q.23   A's income is 25% more than that of B. How much per cent is B's income less than that of A's?

(A) 30%   (B) 40%   (C) 20%   (D) 50%

Q.24   Anurag's salary is increased by 10% and then decreased by 10%. Find the net percentage change in his salary.

(A) increase 1%   (B) decrease 1%   (C) decrease 2%   (D) increase 1%

Q.25   The price of an article has been increased by 25%. By how much per cent must this new price be decreased to retain its former price?

(A) 15%   (B) 17%   (C) 18%   (D) 20%

Q.26   An electronic good dealer purchased an old T.V. set for ₹8700. He spent ₹1100 on its repair and sold it at a profit of 8%. Find his selling price.

(A) 10,584   (B) 10,280   (C) 11,280   (D) 13,250

Q.27   If the cost price of 11 articles is equal to the selling price of 10 articles, find the gain per cent.

(A) 20%   (B) 22%   (C) 15%   (D) 10%

Q.28   A dealer bought 17 fans at ₹460 each. He spent ₹40 as transportation charges and ₹20 per fan on packaging. He sells them at the rate of ₹550 per fan. Find his gain per cent.

(A) $41\dfrac{1}{14}\%$ (B) $14\dfrac{1}{41}\%$ (C) $22\dfrac{1}{41}\%$ (D) $41\dfrac{1}{23}\%$

Q.29   Find the rate of discount being given on a calculator whose selling price is ₹315 after deducting a discount of ₹210 on its marked price.

(A) 30%   (B) 55%   (C) 40%   (D) 23%

Q.30   A merchant offers 8% discount on all his goods and still makes a profit of 15%. If an item is marked ₹250, find its cost price.

(A) 100   (B) 200   (C) 300   (D) 400

Q.31   I purchased a hair dryer for ₹5400 including 8% VAT. Find the price before VAT was added.

(A) 7000   (B) 5000   (C) 6000   (D) 8000

Q.32   The ratio of 50 paise to ₹1 is

(A) 1 : 2   (B) 2 : 1   (C) 1 : 1   (D) 1 : 5

Q.33   The ratio of 10 m to 1 km is

(A) 1 : 10   (B) 10 : 1   (C) 1 : 100   (D) 100 : 1

Q.34   The ratio of 10 km per hour to 30 km per hour is

(A) 3 : 1   (B) 1 : 2   (C) 1 : 3   (D) 2 : 1

Q.35 The ratio 1 : 4 converted to percentage is
(A) 50% (B) 25% (C) 75% (D) 4%

Q.36 The ratio 4 : 25 converted to percentage is
(A) 8% (B) 4% (C) 16% (D) 25%

Q.37 The fraction $\frac{2}{5}$ converted to percentage is
(A) 20% (B) 30% (C) 40% (D) 50%

Q.38 The fraction $\frac{1}{8}$ converted to percentage is
(A) $12\frac{1}{2}$% (B) 25% (C) 8% (D) 16%

Q.39 Out of 40 students in a class, 25% passed. How many students passed?
(A) 20 (B) 10 (C) 30 (D) 40

Q.40 Out of 100 students of a class, 30% like to watch T.V. How many students like to watch T.V.?
(A) 70 (B) 50 (C) 60 (D) 30

Q.41 There are 50 students in a class of which 40 are boys and the rest are girls. The ratio of the number of boys and number of girls is
(A) 2 : 3 (B) 1 : 5 (C) 4 : 1 (D) 2 : 5

Q.42 40% of 50 students of a class are good at Science. How many students are not good at Science?
(A) 20 (B) 30 (C) 10 (D) 40

Q.43 Apala has ₹200 with her. She spent 80% amount she had. How much money is left with her?
(A) ₹10 (B) ₹20 (C) ₹30 (D) ₹40

Q.44 If 20% of x = 40, then x is
(A) 20 (B) 40 (C) 120 (D) 200

Q.45 A mixture of milk and water contains 8 parts of milk and 2 parts of water. The percentage of milk in the mixture is
(A) 80% (B) 8% (C) 40% (D) 20%

Q.46 An alloy contains 20% of copper, 35% zinc and the rest as nickle. In 1.5kg alloy, the quantity of nickle is
(A) 765 g (B) 675 g (C) 575 g (D) 825 g

Q.47 If C.P. of a sofa set is ₹30000 and loss is 1%, then S.P., is
(A) ₹29700 (B) ₹33000 (C) ₹30300 (D) ₹29000

Q.48 If S.P. is ₹ 777.60 and gain is 8%, then C.P. is
(A) ₹ 812.60 (B) ₹ 835.20 (C) ₹ 720 (D) ₹ 820

Q.49 If S.P. of an article is $\frac{3}{2}$ of its C.P., then profit is

(A) ₹ 50　　　　(B) 20%　　　　(C) 50%　　　　(D) 25%

Q.50 A cooker which is generally sold for ₹ 800 was sold for ₹ 700 due to festival season. What per cent discount was allowed ?

(A) $12\frac{1}{2}$%　　(B) 10%　　(C) $14\frac{2}{7}$%　　(D) 15%

Q.51 If x is less than y by 25% then y exceeds x by

(A) $33\frac{1}{3}$%　　(B) 25%　　(C) 75%　　(D) $66\frac{2}{3}$%

Q.52 A man loses 12.5% of his money and after spending 70% of the remainder, has ₹ 210 left. At first the man had

(A) ₹ 720　　　　(B) ₹600　　　　(C) ₹ 800　　　　(D) ₹ 880

Q.53 In a certain examination there were 2500 candidates, of them 20% are girls and the rest boys. Suppose 5% of boys and 40% of girls failed. The percentage of candidates who passed was

(A) 70%　　　　(B) 88%　　　　(C) 66%　　　　(D) 80%

Q.54 A number is increased by 20% and then again by 20%. By what percent should the increased number be reduced so as to get back the original number ?

(A) $30\frac{5}{9}$%　　(B) 42%　　(C) 44%　　(D) 41%

Q.55 In an examination, a student who gets 20% of the maximum marks fails by 5 marks. Another student who gets 30% of maximum marks gets 20 marks more than the pass mark. The necessary percentage required for passing is

(A) 23%　　　　(B) 20%　　　　(C) 32%　　　　(D) 22%

Q.56 If the numerator of a fraction is increased by 140% and the denominator is increased by 150% the

resultant fraction is $\frac{4}{15}$. What is the original fraction

(A) $\frac{4}{18}$　　　(B) $\frac{5}{18}$　　　(C) $\frac{3}{10}$　　　(D) $\frac{3}{5}$

Q.57 A sum of ₹ 731 is dividing among A, B and C, such that A receives 25% more than B and B receives 25% less than C. What is C's share ?

(A) ₹ 272　　　　(B) ₹ 262　　　　(C) ₹ 258　　　　(D) ₹ 200

Q.58 A student multiplied a number by $\frac{3}{5}$ instead of $\frac{5}{3}$. What is the percentage error in the calculation ?

(A) 54%　　　　(B) 34%　　　　(C) 44%　　　　(D) 64%

Q.59   A student secures 90%, 60% and 54% marks in test papers with 100, 150 and 200 respectively as maximum marks. The percentage of his aggregate is
(A) 64%   (B) 70%   (C) 72%   (D) 68%

Q.60   A square is converted to rectangle by increasing its length by 20% and decreasing its width by 20%. Which of the following statement is true ?
(A) Area of rectangle = area of square   (B) Area of rectangle = 120% area of square
(C) Area of rectangle = 96% area of square   (D) Area of rectangle = 50% area of square

Q.61   A businessman allows two successive discount of 20% and 10%. If he gets ₹108 for an article, then its marked price is
(A) ₹ 124   (B) ₹ 140   (C) ₹ 150   (D) ₹ 170

Q.62   A dealer buys a table listed at ₹ 1500 and gets successive discount of 20% and 10%. He spends ₹20 on transportation and sells it at a profit of a 10%. The selling price of the table is
(A) ₹ 1150   (B) ₹ 1210   (C) ₹ 1250   (D) ₹ 1300

Q.63   If the cost price of 9 pens is equal to selling price of 11 pens. The gain or loss %

(A) $18\frac{2}{11}$ Loss   (B) $18\frac{2}{11}$ gain   (C) $16\frac{2}{7}$ (D) $16\frac{2}{7}$ loss

Q.64   A person sells two watches for ₹ 500 each. On one he losts 10% and on the other he gained 105 His gain or loss% is
(A) 1.5% gain   (B) 1.5% loss   (C) 1% loss   (D) 1% gain

Q.65   A sells a bicycle of B at a profit of 20%. B sells it to C at a profit of 25%. If C pays ₹ 225 to it, the cost price of the bicycle for A is
(A) ₹ 115   (B) ₹ 130   (C) ₹ 150   (D) ₹ 140

Q.66   Rekha sold a watch at a profit of 15%. Had she bought it at 10% less and sold it for ₹ 28 less. She would have gained 20%. The C.P. of the watch is
(A) ₹ 250   (B) ₹ 400   (C) ₹ 425   (D) ₹ 450

Q.67   Two shopkeeper A and B sells machines at the same list price. The first (A) allows two successive discounts of 30% and 16% and the second (B) 20% and 26%. Which discount series is more advantageous to the customer ?
(A) Discount offered by 'A'   (B) Discount offered by 'B'
(C) Both are equal   (D) Can't be determined

Q.68   If selling price is doubled, the profit triples, then the profit percent is

(A) 120%   (B) $66\frac{2}{3}$ %   (C) 100%   (D) $103\frac{1}{3}$ %

Q.69   If a person makes a profit of 10% on 1/4th of the quantity sold and a loss of 20% on the rest, then his average percent profit or loss is
(A) 15% profit   (B) 15% loss   (C) 12.5% loss   (D) 12.5% profit

Q.70 A man sold 250 chairs and had a gain equal to selling price of 50 chair ₹ His profit percent is
      (A) 5   (B) 10   (C) 25   (D) 50

Q.71 A shopkeeper on selling a pen for ₹ 10, losses $\dfrac{1}{11}$ th of what it costs to him. The cost price of pen is

      (A) ₹ 9   (B) ₹ 10   (C) ₹ 11   (D) ₹ 12

Q.72 If I purchased 11 books for ₹ 10 and sold all the books at the rate of 10 books for ₹ 11 the profit per cent is
      (A) 10%   (B) 11%   (C) 21%   (D) 100%

Q.73 A dealer professing to sell his goods at cost price, uses a 900 gm weight for a kilogram. His gain percent is

      (A) 9%   (B) 10%   (C) 11%   (D) $11\dfrac{1}{9}$%

Q.74 Toffees are bought at the rate of 3 for a rupee. To gain 50%, they must be sold at
      (A) 2 for a rupee (B) 1 for a rupee (C) 4 for a rupee (D) 5 for a rupee

Q.75 By selling toffees at 20 for a rupee, a man loses 4%. To gain 20%, he must sell
      (A) 16 toffees for a rupee   (B) 20 toffees for a rupee
      (C) 24 toffees for a rupee   (D) 25 toffees for a rupee

Q.76 A dealer sold two cattle for ₹ 500 each. On one of them he lost 10% and on the other, he gained 10%. His gain or loss per cent in the entire transaction was
      (A) 10% loss   (B) 1% gain   (C) 1% loss   (D) neither loss nor gain

Q.77 A man sells two commodities for ₹ 4,000 each, neither loss nor gain in the deal. If he sold one commodity at a gain of 25%, the other commodity is sold at a loss of

      (A) $16\dfrac{2}{3}$%   (B) $18\dfrac{2}{9}$%   (C) 25%   (D) none of these

Q.78 Raghu bought 4 dozen oranges at ₹ 12 per dozen and 2 dozen oranges at ₹ 16 per dozen. He sold them all to earn 20% profit. At what price per dozen did he sell the oranges ?
      (A) ₹ 14.40   (B) ₹ 16   (C) ₹ 16.80   (D) ₹ 19.20

Q.79 At what percent above the cost price must an article be marked so as to gain 33% after allowing the customer at discount of 5% ?
      (A) 38%   (B) 40%   (C) 43%   (D) 48%

Q.80 A shopkeeper professes to sell all things at a discount of 10%, but increases the selling of each article by 205. His gain on each article is
      (A) 6%   (B) 8%   (C) 10%   (D) 12%

Q.81 The compound interest for 1st year and 2nd year on a certain sum will be
      (A) Same   (B) Different
      (C) Depends on principal   (D) Depends on rate of interest

Q.82   A sum of money lent at compound interest yields ₹ 100 at the end of 1st year and ₹ 105 at the 2nd year. The rate % per annum is

(A) 4   (B) 6   (C) $2\dfrac{1}{2}$ (D) 5

Q.83   The C.I. on a certain sum for 2 years in ₹ 41 and S.I. is ₹ 40. Then the rate per annum is

(A) 5%   (B) 4%   (C) $2\dfrac{1}{2}$ %   (D) 8%

Q.84   The compound interest on ₹ 8000 for 1 year at 10% p.a. payable half yearly is
(A) ₹ 820   (B) ₹ 800   (C) ₹400   (D) ₹ 1600

Q.85   The C.I. on ₹ 8000 at 15% p.a. for $\dfrac{1}{3}$ years is

(A) ₹ 9660   (B) ₹ 1660   (C) ₹ 1600   (D) ₹ 4800

Q.86   In what time will ₹ 10000 amount to ₹ 12100 at 10% p.a. compounded annually ?

(A) 3 years   (B) $1\dfrac{1}{2}$ years   (C) 2 years   (D) 1 year

Q.87   The C.I. on a sum of money for 2 years is ₹ 170 and the S.I. on the same sum at the same rate of interest for 3 years is ₹ 240. The rate of interest p.a. is

(A) 8%   (B) $16\dfrac{1}{4}$ %   (C) $12\dfrac{1}{2}$ %   (D) $7\dfrac{1}{2}$ %

Q.88   The present population of a town is 150000. The population of the town increases 4% annually. The population after 2 years will be
(A) 152240   (B) 162240   (C) 163240   (D) 153240

Q.89   Nanoo and Meenu borrowed ₹ 400 each at 10% interest per annum. Nanoo borrowed at compound interest. If both the cases, the interest was calculated half yearly. At the end of one year
(A) Both paid the same amount as interest   (B) Nanoo paid ₹ 1 more as interest
(C) Meenu paid ₹ 5 more as interest   (D) Meenu paid ₹ 5 less as interest

Q.90   The population of a village increase @5% p.a. If present population is 8000, after how many years the population will be 9261 ?

(A) 2 years   (B) 3 years   (C) $3\dfrac{1}{2}$ years   (D) 4 years

Q.91   Of a certain sum, $\dfrac{1}{3}$ rd is invested at 3%, $\dfrac{1}{6}$ th at 6% and the rest at 8%. If the SI for 2 years from all these investments amount to ₹ 600, then the original sum was
(A) ₹ 2000   (B) ₹ 3000   (C) ₹ 4000   (D) ₹ 5000

Q.92 Bhanu borrowed a certain sum of moeny at 12% per annum for 3 years and Madhuri borrowed the same sum at 24% per annum for 10 years. The ratio of their amounts, is
(A) 1 : 3   (B) 2 : 1   (C) 2 : 3   (D) 2 : 5

Q.93 Compound interest on ₹ 25000 at 20% p.a. for $2\frac{1}{2}$ years, if interest is compounded annually, is
(A) ₹ 39600   (B) ₹ 14600   (C) ₹ 37500   (D) ₹ 12500

Q.94 A certain sum of money invested at a certain rate of compound interest doubles in 5 years. In how many years will it become 4 times ?
(A) 10 years   (B) 12 years   (C) 15 years   (D) 20 years

Q.95 The difference between CI and SI on ₹ 8000 for 3 years at 2.5% p.a. is
(A) ₹15.125   (B) ₹ 10.125   (C) ₹ 18.125   (D) ₹ 19.125

Q.96 A sum of money, put out at compound interest, becomes ₹ 672 in two years and ₹ 714 in three years the rate of interest is
(A) 5% per annum   (B) 6% per annum   (C) $6\frac{1}{4}$ per annum   (D) $7\frac{1}{2}$ % per annum

Q.97 The least number of complete year in which sum of money at 20% will be mroe than doubled is
(A) 8 years   (B) 10 years   (C) 12 years   (D) 4 years

Q.98 The value of a machine depreciates @25% p.a. If its present value is ₹ 14400. The value of machine 2 years ago is
(A) ₹ 8100   (B) ₹ 9216   (C) ₹ 22500   (D) ₹ 25600

Q.99 The correct formula is

(A) $Principal = Amount \left(1 + \dfrac{Rate}{100}\right)^{Time}$ (B) $Amount = Principal \left(1 + \dfrac{Rate}{100}\right)^{Time}$

(C) $Amount = Principal \left(1 + \dfrac{Rate}{100}\right)^{Rate}$ (D) None of these

Q.100 The difference between the compound interest compounded annually and the simple interest on ₹ 625 at 10% per annum for 1 year is
(A) ₹ 10   (B) ₹ 100   (C) ₹ 15   (D) 0

Q.101 A sum becomes ₹ 3,136 after 2 years at 12% per annum compounded annually. The sum is
(A) ₹ 2,000   (B) ₹ 2,500   (C) ₹ 3,000   (D) ₹ 3,500

Q.102 David borrowed ₹ 1,500 at 8% simple interest for 2 years and he lent it to Tahir for 2 years at 10% per annum compound interest, compounded annually. David's profit is :
(A) ₹ 240   (B) ₹ 315   (C) ₹ 75   (D) none of these

Q.103 The amount for sum of ₹ 600 for 1 year at the rate of 20% p.a. compounded half-yearly is
       (A) ₹ 626   (B) ₹ 640   (C) ₹ 720   (D) ₹ 726

Q.104 On which of the following percent profit or percent loss is calculated ?
       (A) S.P.   (B) C.P.   (C) marked price   (D) none of these

Q.105 The discount is always calculated on which of the following ?
       (A) S.P.   (B) C.P.   (C) marked price   (D) none of these

Q.106 VAT is always calculated on which of the following ?
       (A) S.P.   (B) C.P.   (C) marked price   (D) none of these

Q.107 If interest is compounded half yearly then time period in taken :
       (A) twice as much as the number of given years (B) half as much as the number of given years
       (C) same as the number of given years   (D) none of these

Q.108 If the interest is compounded quaraterly, then the 'rate of interest per annum' :
       (A) reduced to half   (B) reduced to one-fourth
       (C) is doubled   (D) becomes four times

Q.109 If the marked price of an iterm is ₹ 10 and a discount of 10% is allowed then its sales price is
       (A) ₹ 10   (B) ₹ 9   (C) ₹ 11   (D) none of these

Q.110 A machinery worth ₹ P is depreciated by 5% per annum. Which of the following will be its value after 1 year ?

   (A) $P\left[1-\dfrac{5}{100}\right]$ (B) $P\left[1+\dfrac{5}{100}\right]$ (C) $P\left[\left(1+\dfrac{5}{100}\right)-1\right]$ (D) $P\left[1-\left(1-\dfrac{5}{100}\right)\right]$

Q.111 If the marked price of an item is ₹ 1050 and sales price is ₹ 1000 then discount is :

   (A) 5%   (B) $4\dfrac{16}{21}\%$ (C) $5\dfrac{5}{19}\%$ (D) none of these

Q.112 An article marked at 10% more than its cost price. If a discount of 10% is allowed then which of the following is true ?
       (A) 1% gain   (B) 1% loss   (C) no gain and no loss (D) 1.1% loss

Q.113 If an article sold for ₹ 100 then there is a gain of ₹ 20, which of the following is the gain percent ?

   (A) 25%   (B) 22%   (C) 20%   (D) $16\dfrac{2}{3}\%$

Q.114 An amount becomes 6 times in 7 years when invested under S.I. at a certain rate. In how many years will the amount become 16 times of the original amount at the same rate?   **[IMO-2016]**
       (A) 28 years   (B) 20 years   (C) 21 years   (D) 30 years

Q.115 If 35% of a number is 12 less than 50% of that number, then the number is _____. **[IMO-2016]**
(A) 40   (B) 50   (C) 60   (D) 80

Q.116 The monthly income of Komal and Asha are in the ratio of 4 : 3. Their monthly expenses are in the ratio of 3 : 2. However both saves ₹600 per month. What is their total monthly income? **[IMO-2016]**
(A) ₹8400   (B) ₹5600   (C) ₹4200   (D) ₹2800

Q.117 Sudharshan invested ₹15,000 at the rate of 10% per annum compounded half yearly. What amount will Sudharshan get at the end of the year? **[IMO-2016]**
(A) ₹16,537.50   (B) ₹16,500   (C) ₹16,525.50   (D) ₹18,150

Q.118 A house is purchased by Mohit, Arun and Armaan. Arun contributes $\dfrac{23}{60}$ of Mohit's contribution while,

Armann contributes $\dfrac{1}{3}$ of Mohit's contribution. If Mohit's contribution is ₹1500000, then find the

contribution of Armaan and Arun. **[IMO-2016]**
(A) ₹5,00,000, ₹5,75,000   (B) ₹5,00,000, ₹6,75,000
(C) ₹6,00,000, ₹5,00,000   (D) ₹6,25,000, ₹5,25,000

Q.119 Raju purchased item for ₹4,500 and sold it at a gain of 15%. From that amount he purchased another item and sold it at a loss of 10%. What is his overall gain/loss? **[IMO-2016]**
(A) Gain of ₹152.50   (B) Gain of ₹157.50
(C) Loss of ₹165   (D) Neither gain nor loss

Q.120 A man had ₹4800 in his locker two years ago. In the first year, he deposited 20% of the amount in his locker. In the second year, he deposited 25% of the new amount in his locker. Find the amount at present in his locker. **[IMO-2016]**
(A) ₹5200   (B) ₹6800   (C) ₹7200   (D) ₹8000

Q.121 If A = $\dfrac{1}{4}$ B and B = $\dfrac{1}{2}$ C, then find the value of A : B : C. **[IOM-2016]**
(A) 8 : 4 : 1   (B) 4 : 2 : 1   (C) 1 : 4 : 8   (D) 1 : 2 : 4

Q.122 Harry wants to mix the flour of two different rates so that he can sell at the rate he wants. In what proportion he must mix the flour at ₹16.6 per kg with another flour at ₹16.45 per kg so that the mixture can be sold at the rate of ₹16.54 per kg? **[IOM-2016]**
(A) 1 : 3   (B) 4 : 3   (C) 1 : 2   (D) 3 : 2

Q.123 The ratio of the ages of two boys is 3 : 4. After 3 years, the ratio will be 4 : 5. The ratio of their ages after 21 years will be **[IOM-2016]**
(A) 14 : 17   (B) 17 : 19   (C) 11 : 12   (D) 10 : 11

Q.124   When principal = ₹S, rate of interest = 2r% p.a., then a person will get the amount after 3 years at compound interest   **[IOM-2016]**

(A) ₹ $S\left(1+\dfrac{r}{100}\right)^3$ (B) ₹ $3S\left(1+\dfrac{r}{100}\right)^3$ (C) ₹ $S\left(1+\dfrac{r}{50}\right)^3$ (D) ₹ $\dfrac{6Sr}{100}$

Q.125   In a partnership business, B's capital was half of A's. If after 8 months, B withdrew half of his capital and after 2 months more A withdrew $\dfrac{1}{4}$ th of his capital, then the profit ratio of A and B will be

[IOM-2016]

(A) 10 : 23   (B) 23 : 10   (C) 5 : 2   (D) 2 : 5

Q.126   A sum of money placed at a compound interest doubles itself in 5 years. It will amount to eight times itself at the same rate of interest in   **[IOM-2016]**
(A) 12 years   (B) 10 years   (C) 20 years   (D) 15 years

Q.127   A sum of ₹7,930 is divided into 3 parts and given a loan at 5% simple interest to A, B and C for 2, 3 and 4 years respectively. If the amounts of all three are equal after their respective periods of loan, then A received a loan of   **[IOM-2016]**
(A) ₹3,050   (B) ₹2,760   (C) ₹2,800   (D) ₹2,750

Q.128   There were two different copper alloys of total weight 50 kg. The first contains 40% less copper than the second. Determine the percentage of copper in the first and second alloys, if it is known that there were 6 kg of copper in the first alloy and 12 kg in the second.   **[IOM-2016]**
(A) 20%, 80%   (B) 16%, 78%   (C) 20%, 60%   (D) 30%, 70%

SECTION - C
●   **PASSAGE**
Passage – 1
The cost of producing a magazine is made up from two parts, typing and printing. In 2009 the typing cost ₹ 3.00 for every page and the printing cost ₹ 18.50 for every 100 copies of the magazine.

Q.1   Find the total cost of producing 600 copies of a magazine with 32 pages.

Q.2   The magazines were sold for 40 paise each.
(A) Find the number of magazines that needed to be sold so that no loss was made.
(B) Calculate the percentage profit that would have been made if all of these 600 magazines were sold.
(C) 4% of the magazines were given away, and the remainder were sold. Find the profit that was actually made.

Passage-2
Rihana lives in Chennai. Her friend Suhana lives in Bombay. On a weekday evening Rihana can call Suhana long distance and talk for 10 min for ₹ 500. If she calls on Sunday, there is a 35% discount.
Q.3   The cost of a 20 min call on Sunday is
(A) 650   (B) 6.50   (C) 65.0   (D) 0.650

Q.4   How long would Rihana talk on Sunday for ₹ 5.00 ?
(A) 8 min   (B) 7 min   (C) 10 min   (D) 6 min

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SECTION - D

</div>

- **ASSERTION & REASON**
  (A) If both **Assertion** and **Reason** are correct and Reason is the **correct explanation** of Assertion.
  (B) If both **Assertion** and **Reason** are correct, but Reason is the **not the correct explanation** of Assertion.
  (C) If **Assertion** is correct but Reason is the **incorrect**.
  (D) If **Assertion** is incorrect but Reason is the **correct**.

Q.1   **Assertion :** If 'a' is x% more than 'b' and 'b' is y% less than 'a'. Then relation between x and y is

$$\frac{1}{y} - \frac{1}{x} = \frac{1}{100}$$

Reason : If 'a' exceeds 'b' by P% then 'b' is short of 'a' by $\dfrac{100 \times P}{100 + P}$ %.

Q.2   **Assertion :** Two whole numbers whose sum is 64, cannot be in the ratio 3 : 4.
Reason : For dividing a number into two whole numbers, the sum of the terms of the ratio must be a factor of that number.

Q.3   **Assertion :** The numbers 4, 6 and 9 are in continued proportion.
Reason : The numbers 2, 4, 6 are also in continued proportion.

Q.4   In a test on percent application Priyanka answered 28 of the 35 questions correctly.
Assertion : She answered 80% of the questions correctly.
Reason : She answered 20% of the question correctly.

Q.5   **Assertion :** An article is sold at ₹ 1425 at a loss of 5%. It's C.P. is ₹ 1500.
Reason : If the shopkeeper has to make a 10% profit in question given statement then the S.P. should be ₹ 6150.

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SECTION - E

</div>

- **MATCH THE COLUMN**
Q.1   Match the column

	Column I		**Column II**
(A)	Percentage is	(p)	a fraction whose denominator is 100.
(B)	Selling price is	(q)	$\dfrac{\text{Principle} \times \text{rate} \times \text{time}}{100}$
(C)	Simple interest is	(r)	$\left(\dfrac{\text{One quantity}}{\text{Other quantity}} \times 100 \right)\%$
		(s)	$\left(1 + \dfrac{\text{Profit}}{100} \right) \times \text{C.P.}$
		(t)	C.P. – Loss
		(u)	Amount – Principal

Q.2   **Column I**   **Column II**
(A)   Marked price is   (p)   marked price – selling price
(B)   Net price is   (q)   the price printed on the items.
(C)   Discount is   (r)   the price payable after reducing the discount from the marked price
                              (s)   the reduction given on the marked price by the shopkeeper

                              (t) $\dfrac{100 \times \text{S.P.}}{100 - \text{Rate of discount}}$

Q.3   **Column I**   **Column II**
(A)   VAT is calculate on _____ price   (i)   marked price
(B)   Discount is always counted on the _____ price   (ii)   Twice
(C)   Profit or loss is always calculated on _____ price   (iii) Half
(D)   If the interest compounded half yearly the time period   (iv)   Selling price
       become _____ .
(E)   If the interest compounded half yearly the rate of interest (v)   Cost price
       become _____ .

Q.4   **Column I**   **Column II**
(A)   1 cm to 2 m   (p)   1 : 1000
(B)   1 min to 1 h   (q)   24 : 1
(C)   1m to km   (r)   1 : 365
(D)   1 day to 1h   (s)   1 : 200
(E)   1 day to 1 year   (t)   1 : 60

Q.5   **Column I**   **Column II**
(A)   The ratio of 3.5 kg to 280 gm is   (p)   10.20
(B)   The compound ratio of 3 :4, 8 : 15 and 25 : 28 is (q)   0.05
(C)   0.35% of a number is equivalent to multiplying it
       by the number   (r)   5 : 14
(D)   20% of 30% of 20% of ₹ 850 is   (s)   25 : 2
(E)   Half of 1 percent written as a decimal is   (t)   0.0035

SECTION - F

● **CHART BASED QUESTION**

Q.1   Study the Menu chart and answer the following questions based on it.
       (i)   A family went for a dinner and paid bill as follows.
              Tea = ₹ 194.40;   Dosa = ₹ 105;   Kadai Paneer = ₹ 98;   Chowmein = ₹ 46
       Find the profit earned by the restaurant on this bill ?
       (ii) Find the difference in the profit percent in the following two payments
       (a)   Tea → ₹ 129.60;   Dosa → ₹ 214.20; Chowmein → ₹ 99;   Rice → ₹ 234
       (b)   Tea → ₹ 302.40;   Dosa → ₹ 119;   Chowmein → ₹ 173.25

Picture based questions

Q.1
| **Summer Special** |
| Save 20% on Vanilla Ice cream maker |
| Rs. 36.00 |

Reena, Anshi and Dipanshu want to buy the ice cream maker as a birthday present for their mother.
Study the advertisement and find the sale price.

ANSWER KEY

CONCEPT APPLICATION LEVEL - II

SECTION -A

Q.1	Per hundred.	Q.2	38%	Q.3	VAT	Q.4	Cost price
Q.5	Selling	Q.6	Profit	Q.7	Loss	Q.8	percent
Q.9	percent	Q.10	overhead	Q.11	Principal	Q.12	Amount
Q.13	Rate	Q.14	VAT	Q.15	150	Q.16	Yes

Q.17 $\text{Amount} = P\left(1 + \dfrac{r}{100}\right)^n$　　　Q.18 $\text{S.I.} = \text{Amount} - \text{Principal}$　　　Q.19 0

Q.20	C.I.	Q.21	No	Q.22	5% p.a.	Q.23	6% p.a.	Q.24	6
Q.25	Discount	Q.26	Rate	Q.27	Selling Price	Q.28	Ratio	Q.29	Interest
Q.30	Annually	Q.31	Cost price						

SECTION -B

Q.1	A	Q.2	B	Q.3	B	Q.4	A	Q.5	C	Q.6	B	Q.7	B
Q.8	D	Q.9	C	Q.10	D	Q.11	A	Q.12	A	Q.13	D	Q.14	C
Q.15	A	Q.16	C	Q.17	D	Q.18	B	Q.19	A	Q.20	B	Q.21	B
Q.22	D	Q.23	C	Q.24	B	Q.25	D	Q.26	A	Q.27	D	Q.28	B
Q.29	C	Q.30	B	Q.31	B	Q.32	A	Q.33	C	Q.34	C	Q.35	B
Q.36	C	Q.37	C	Q.38	A	Q.39	B	Q.40	D	Q.41	C	Q.42	B
Q.43	D	Q.44	D	Q.45	A	Q.46	B	Q.47	A	Q.48	C	Q.49	C
Q.50	A	Q.51	A	Q.52	C	Q.53	B	Q.54	A	Q.55	D	Q.56	B
Q.57	A	Q.58	D	Q.59	D	Q.60	C	Q.61	C	Q.62	B	Q.63	A
Q.64	C	Q.65	C	Q.66	B	Q.67	A	Q.68	C	Q.69	C	Q.70	C
Q.71	C	Q.72	C	Q.73	D	Q.74	A	Q.75	A	Q.76	C	Q.77	A
Q.78	B	Q.79	B	Q.80	B	Q.81	B	Q.82	D	Q.83	A	Q.84	C
Q.85	B	Q.86	C	Q.87	C	Q.88	B	Q.89	B	Q.90	B	Q.91	D
Q.92	D	Q.93	B	Q.94	A	Q.95	A	Q.96	C	Q.97	D	Q.98	D
Q.99	B	Q.100	D	Q.101	B	Q.102	C	Q.103	D	Q.104	B	Q.105	C
Q.106	A	Q.107	A	Q.108	B	Q.109	B	Q.110	A	Q.111	B	Q.112	B
Q.113	A	Q.114	B	Q.115	D	Q.116	C	Q.117	A	Q.118	A	Q.119	B
Q.120	C	Q.121	C	Q.122	D	Q.123	D	Q.124	C	Q.125	B	Q.126	D
Q.127	B	Q.128	C										

SECTION - C

Q.1　96　　Q.2　(A) 518　　　(B) 15.9%　　(C) 207　　Q.3　B　　Q.4　A

SECTION - D

Q.1　A　　Q.2　A　　Q.3　C　　Q.4　C　　Q.5　C

SECTION - E

Q.1　(A) → p, r, (B) → s, t (C) → q, u
Q.2　(A) → q, t, (B) → r (C) → p, s
Q.3　(A) → (iv); (B) → (i); (C) → (v); (D) → (ii); (E) → (iii)
Q.4　(A) → s, (B) → t, (C) → p, (D) → q, (E) → r
Q.5　(A) → s, (B) → r, (C) → t, (D) → p, (E) → q

SECTION - F

Q.1　28.80