Lesson 2

Compound Interest

2.0 Review

Discuss the following questions and present the conclusion in the classroom:

A person borrowed Rs. 10,00,000 for a business from a commercial bank.

a) How much interest should he pay to the bank after 2 years at the rate of 8% per annum?

b) What total sum of money should he pay after 2 years? What is the sum of money called?

c) If he had borrowed the money for 5 years, how much interest should be paid at the same interest rate?

The conclusion drawn from the discussion is presented below:

The sum of money paid to the bank at the rate of 8% p.a. after 2 years is called simple interest.

The total sum of borrowed money and additional interest is called amount. The following formula is used for the calculation of simple interest: Simple interest (SI) = $\frac{P\,T\,R}{100}$

2.1. Introduction of Compound Interest

2.1.1 Compound Interest Compounded Annually

Activity1

A teacher borrowed Rs. 5,00,000 for 2 years at the interest rate of 12% per annum from a commercial bank. He could not pay the interest at the end of the first year so that he had to pay interest of interest of the first year in the second year. In this situation, discuss the following questions and present the conclusion in the classroom:

a) How much interest to be paid in the first year?

b) What is the principal of the second year? Find it.

c) How much interest of second year should be paid?

The conclusion from the discussion is mentioned below:

The interest to be paid in the first year (I_1) $= \frac{P\,T\,R}{100} = \frac{5,00,000 \times 1 \times 12}{100}$

$= \text{Rs. } 60,000$

Since he could not pay the interest in the first year,

The principal for the second year (P_1) = Rs. 5,00,000 + Rs. 60,000 = Rs. 5,60,000

Thus, the interest for the second year $(I_2) = \frac{P_1 T R}{100} = \frac{5,60,000 \times 1 \times 12}{100}$

= Rs. 67,200

Hence, the total interest to be paid by the teacher = Rs. 60,000 + Rs. 67,200 = Rs. 1,27,200

Why is there difference between the interests for the first year and for the second year?

If the interest of a principal after every year or after certain period (yearly, half yearly or terminal) is calculated and added to the principal and again the interest is calculated, then the interest so obtained is called compound interest. The sum of the principal and compound interest is called compound amount.

Activity 2

Bishal and Badri borrowed Rs. 30,000 each from a bank for 3 years at the rate of 10% yearly with the promise that Bishal should pay simple interest and Badri should pay compound interest. Discuss the following questions based on the information:

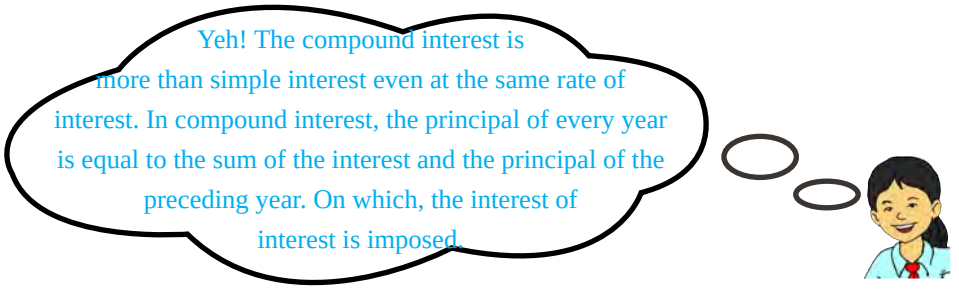
a) How much total interest should Bishal pay?

b) How much total interest should Badri pay?

c) Who should pay more interest?

Should be paid by Bishal (SI)	Should be paid by Badri (CI)
For the first year, Principal (P_1) = Rs. 30,000 Rate of interest (R) = 10%, Time (T_1) = 1 year Interest $(I_1) = \frac{30,000 \times 10 \times 1}{100}$ = Rs. 3,000	For the first year, Principal (P_1) = Rs. 30,000 Rate of interest (R) = 10%, Time (T_1) = 1 year Interest (I_1) = $(I_1) = \frac{30,000 \times 10 \times 1}{100}$ = Rs. 3,000
For the second year, Principal (P_2) = Rs. 30,000 Rate of interest (R) = 10%, Time (T_2) = 1 year Interest $(I_2) = \frac{30,000 \times 10 \times 1}{100}$ = Rs. 3,000	For the second year, Principal (P_2) = Rs.30,000 + Rs. 3,000 = Rs. 33,000 Rate of interest (R) = 10%, Time (T_2) = 1 year Interest $(I_2) = \frac{33,000 \times 10 \times 1}{100}$ = Rs. 33,00

For the third year, Principal (P_3) = Rs. 30,000 Rate of interest (R) = 10%, Time (T_3) = = 1 year Interest (I_3) = $\frac{30{,}000 \times 10 \times 1}{100}$ = Rs. 3,000 Total interest (I) = $I_1 + I_2 + I_3$ = 3000 + 3000 + 3000 = Rs. 9,000	For the third year, Principal (P_3) = Rs. 33,000 + Rs. 3,300 = Rs. 36,300 Rate of interest (R) = 10%, Time (T_3) = 1 year Interest (I_3) = $\frac{36{,}300 \times 10 \times 1}{100}$ = Rs. 3,330 v (I) = $I_1 + I_2 + I_3$ = 3000 + 3300 + 3630 = Rs. 9,930



While calculating simple interest, the principal is same for each year. But while calculating compound interest, the principals are different every year (the principal for the second year is the amount of the first year, the principal for the third year is the amount of second year, etc.). The compound interest of the same principal is more at the same rate and time than the simple intrest of the same principal.

Activity 3

If a principal (P) is deposited at the rate of R% per annum for T years, then discuss the following questions:

a) How much interest is at the end of the first year?

b) How much interest is at the end of the second year?

c) In this way, how much interes ist at the end of the third year?

d) How much interest is at the end of T years?

The interest at the end of the first year $(I_1) = \frac{P \times T \times R}{100} = \frac{P \times 1 \times R}{100} = \frac{PR}{100}$

The amount at the end of the first year $(A_1) = P_1 + I_1 = P + \frac{PR}{100} = P\left(1 + \frac{R}{100}\right)$

We know that,

The amount at the end of the first year = Principal for the second year

Thus, the principal of the second year $(P_2) = P\left(1 + \frac{R}{100}\right)$

The interest of the second year $(I_2) = \frac{P\left(1 + \frac{R}{100}\right) \times T \times R}{100}$

$$= \frac{P\left(1 + \frac{R}{100}\right) \times 1 \times R}{100} = P\left(1 + \frac{R}{100}\right) \times \frac{R}{100}$$

The amount at the end of the second year $(A_2) = P\left(1 + \frac{R}{100}\right) + P\left(1 + \frac{R}{100}\right) \times \frac{R}{100}$

$$= P\left(1 + \frac{R}{100}\right)\left(1 + \frac{R}{100}\right)$$

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

In this way, the amount at the end of second year = principal for the third year

Thus, principal for the third year $(P_3) = P\left(1 + \frac{R}{100}\right)^2$

Interest of the third year $(I_3) = \frac{P_3 \times T \times R}{100} = \frac{P\left(1 + \frac{R}{100}\right)^2 \times 1 \times R}{100}$

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

The amount at the end of the third year $(A_3) = P_3 + I_3$

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

$$= P\left(1 + \frac{R}{100}\right)^2\left(1 + \frac{R}{100}\right) = P\left(1 + \frac{R}{100}\right)^3$$

From the above calculation, what will be the compound amount (CA) at the end of T years?

Hence, the compound amount at the end of T years $(CA) = P\left(1 + \frac{R}{100}\right)^T$

Similarly, compound interest (CI) = Amount (CA) – Principal (P)

$$CI = P\left(1 + \frac{R}{100}\right)^T - P, \qquad CI = P\left[\left(1 + \frac{R}{100}\right)^T - 1\right]$$

Activity 4

How shall we calculate compound interest and compound amount of the following conditions?

a) The rate of interest is different every year.

b) Time in T years and M months.

c) If the interest is to be calculated half yearly.

d) If the interest is to be calculated terminally.

(a) The rate of interest is different every year

How can we calculate compound interest and compound amount in 3 years such that the rate of interest for the first year R_1%, the second year R_2% and the third year R_3% respectively?

$$\text{Compound Amount (CA)} = P\left(1+\frac{R_1}{100}\right)\left(1+\frac{R_2}{100}\right)\left(1+\frac{R_3}{100}\right) \text{ and,}$$

$$\text{Compound Interest (CI)} = P\left[\left(1+\frac{R_2}{100}\right)\left(1+\frac{R_2}{100}\right)\left(1+\frac{R_3}{100}\right)-1\right]$$

(b) If Time in 'T' years and 'M' months is given, how shall compound interest and compound amount be computed?

$$\text{Compound Amount (CA)} = P\left(1+\frac{R}{100}\right)^T\left(1+\frac{MR}{1200}\right)$$

$$\text{Compound Interest (CI)} = P\left[\left(1+\frac{R}{100}\right)^T\left(1+\frac{MR}{1200}\right)-1\right]$$

(c) If the interest is to be calculated half yearly

If the interest is to be calculated half yearly, the rate of interest R% per annum being calculated as $\frac{R}{2}$% per semi-annual and Time (T) being calculated as 2×T.

Now, compound amount (CA) is $P\left(1+\frac{R}{2\times 100}\right)^{2T} = P\left(1+\frac{R}{200}\right)^{2T}$

And compound interest CI is $P\left(1+\frac{R}{2\times 100}\right)^{2T} - P = P\left[\left(1+\frac{R}{200}\right)^{2T}-1\right]$.

A financial institution releases the interest at the rate of R% yearly in the account of depositors two times, the first of Magh and the first of Shrawan every year. In this way, the interest of following 6 months is computed at the principal as the sum of the interest of the previous 6 months and the principal. This kind of interest is called half yearly compound interest.

What is the difference between yearly compound interest and half yearly compound interest? Discuss.

(d) If the interest is to be calculated terminally

If the principal and interest in a bank is to be computed terminally, then rate of interest R% is termed as $\frac{R}{4}$% per quarter and time (T) is termed as 4T per quarter. In this case,

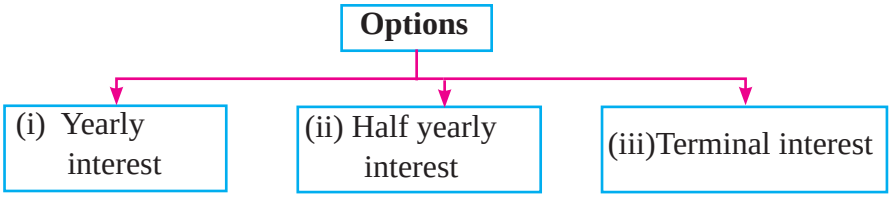
$$\text{Compound amount (CA)} = P\left(1 + \frac{R}{4 \times 100}\right)^{4T} = P\left(1 + \frac{R}{400}\right)^{4T}$$

$$\text{And compound interest (CI)} = P\left(1 + \frac{R}{4 \times 100}\right)^{4T} - P = P\left[\left(1 + \frac{R}{400}\right)^{4T} - 1\right]$$

Terminal compound interest is also computed as the yearly compound interest and half yearly compound interest.

Activity 5

Your uncle has planned to invest Rs. 1,00,000 for a year at the rate of 15% compound interest per annum. He has been thinking about whether to invest it in yearly interest, half yearly interest or terminal interest to get more benefit. Which alternative would you suggest him to choose? Why? Discuss.



Here, principal (P) = Rs. 1,00,000, the rate of interest (R) = 15%, time (T) = 1 year

a) According to the first option,

$$\text{Compound interest (CI)} = 1{,}00{,}000\left[\left(1 + \frac{15}{100}\right)^{1} - 1\right]$$

$$= 1{,}00{,}000\left[\left(\frac{115}{100}\right) - 1\right] = \text{Rs. } 15{,}000$$

b) According to the second option,

$$\text{Compound interest (CI)} = 1{,}00{,}000\left[\left(1 + \frac{15}{200}\right)^{2\times1} - 1\right] = \text{Rs. } 15{,}562.50$$

c) According to the third option,

$$\text{Compound interest (CI)} = 1{,}00{,}000\left[\left(1 + \frac{15}{400}\right)^{4\times1} - 1\right] = \text{Rs. } 15{,}865.04$$

Out of these three options, I would suggest him to invest according to the third option because the interest of this option is more than that of other two options. Accordingly, the interest is Rs. 865.04 more than the first option and Rs. 562.50 more than the second option.

While calculating the interest of the same sum at the same rate of interest at the same time, then terminal compound interest is more than half yearly compound interest and helf yearly compound interest is greater than yearly compound interest.

Example 1

What will be the compound interest and compound amount of Rs. 2,000 at the interest rate of 12% p.a. in 2 years? Find the compound interest without using formula.

Solution

Here,

Principal (P_1) = Rs. 2,000

Rate of interest (R) = 12% p.a.

Time (T) = 2 years

At the end of the first year, simple interest (I_1) = $\frac{P_1 T R}{100} = \frac{2000 \times 1 \times 12}{100}$ = Rs. 240

Principal for the second year (P_2) = Amount at the end of the first year

$= P_1 + I_1$ = Rs. (2000 + 240)

= Rs. 2,240

Again, simple interest for the second year (I_2) = $\frac{2240 \times 1 \times 12}{100}$ = Rs. 268.8

Thus, the compound interest at the end of 2 years (CI) = $I_1 + I_2$ = 240 + 268.8 = Rs. 508.8

Compound amount (CA) = P_1 + CI = 2000 + 508.8 = Rs. 2,508.8

Example 2

Find the compound interest and compound amount of the borrowed amount of Rs. 25,000 which is paid in exactly 3 years at the rate of yearly compound interest rate 12%.

Solution

Principal (P) = Rs. 25,000

Rate of interest (R) = 12% per year

Time (T) = 3 year

Compound interest and compound amount = ?

According to the formula,

Compound interest (CI) $= \left[\left(1 + \frac{R}{100}\right)^T - 1\right]$

$= 25{,}000\left[\left(1 + \frac{12}{100}\right)^3 - 1\right]$

$= 25{,}000\left[\left(\frac{112}{100}\right)^3 - 1\right]$

$= 25{,}000\ [1.404928 - 1]$

$= 25{,}000 \times 0.404928$

$= 10123.20$

Again, compound amount (CA) $= P + CI$

$=$ Rs. 25,000 + Rs. 10,123.20 = Rs. 35,123.20

Example 3

A man borrowed Rs. 32,000 from his friend at the rate of simple interest of 12.5% per annum. He lent the whole sum to a shopkeeper at the same rate of compound interest. How much more money will he get in 3 years? Find.

Solution

Here,

Principal (P) = Rs. 32,000

Rate of interest (R) = 12.5%

Time (T) = 3 year

Simple interest (SI) = ?

Compound interest (CI) = ?

Case I : simple interest (SI) $= \frac{P\,T\,R}{100} = \frac{32000 \times 3 \times 12.5}{100}$ = Rs. 12,000

Case II : compound interest (CI) $= P\left[\left(1 + \frac{R}{100}\right)^T - 1\right]$

$= 32{,}000\left[\left(1 + \frac{12.5}{100}\right)^3 - 1\right]$

$$= 32{,}000\left[\left(\frac{112.5}{100}\right)^3 - 1\right]$$

$$= 32{,}000\ [1.423828125 - 1]$$

$$= 32{,}000 \times 0.423828125$$

$$= \text{Rs. } 13562.50$$

$\therefore$ The more money received by the man = CI – SI = 13562.50 – 12000 = Rs. 1562.50

Example 4

Sameer decided to invest Rs. 5,000 at the rate of 8% per annum for 2 years. For this, he has two safe alternative. The first alternative is to get half yearly compound interest and the second alternative is to get yearly compound interest. If you were to suggest him, which alternative would you suggest? Write with reason.

Solution

Here,

Principal (P) = Rs. 5,000

Rate of interest (R) = 8%

Time (T) = 2 year

a) According to the first alternative,

Half yearly compound interest $(CI_1) = P\left[\left(1 + \frac{R}{200}\right)^{2T} - 1\right]$

$$= 5{,}000\left[\left(1 + \frac{8}{200}\right)^{2\times 2} - 1\right]$$

$$= 5{,}000\left[\left(\frac{208}{200}\right)^{2\times 2} - 1\right]$$

$$= 5{,}000[\ 1.16985856 - 1]$$

$$= 5{,}000 \times 0.16985856$$

$$= \text{Rs. } 849.29$$

b) According to the second alternative,

Yearly compound interest $(CI_2) = P\left[\left(1 + \frac{R}{100}\right)^T - 1\right]$

$= 5000\left[\left(1 + \frac{8}{100}\right)^2 - 1\right]$

$= 5000\left[\left(\frac{108}{100}\right)^2 - 1\right]$

$= 5000[(1.08)^2 - 1]$

$= 5000\ (1.1664 - 1)$

$= 5000 \times 0.1664$

$=$ Rs. 832

The difference between half yearly compound interest and yearly compound interest is given by $CI_1 - CI_2$ = Rs. 849.29 – Rs. 832 = Rs. 17.29

∴ Since half yearly compound interest is Rs. 17.29 more than yearly compound interest, I would suggest him to invest in first alternative.

Example 5

A twelve-grade student invest Rs. 10,000 for 2 years at the rate of yearly compound interest. If the compound interest in 1 year is Rs. 11,200

(a) Find the rate of yearly compound interest.

(b) Find the yearly compound amount at the end of the second year.

Solution

Here, (a) Principal (P) = Rs. 10,000

Compound amount at the end of the first year (CA) = Rs. 11,200

Time $(T_1) = 1$ year

Using the formula, $(CA) = P\left(1 + \frac{R}{100}\right)^T$

or, $11200 = 10000\left(1 + \frac{R}{100}\right)^1$

or, $\frac{11200}{10000} = 1 + \frac{R}{100}$

or, $1.12 = 1 + \frac{R}{100}$

or, $0.12 \times 100 = R$

or, $R = 12\%$

Thus, the rate of yearly compound interest is 12%.

(b) The compound amount at the end of the second year (CA) = ?

Time (T) = 2 year

Compound amount (CA) $= P\left(1 + \frac{R}{100}\right)^T$

$= 10{,}000\left(1 + \frac{12}{100}\right)^2$

$= 10{,}000\left(\frac{112}{100}\right)^2$

= Rs. 12,544

Thus, the compound amount at the end of the second year = Rs. 12,544

Example 6

Find the compound interest and compound amount of Rs. 2,00,000 invested for 3 years such that the rate of interest for the first year is 8% p.a., for the second it is year 10% p.a. and for the third year it is 12%.

Solution

Here,

Principal (P) = Rs. 2,00,000

Time (T) = 3 year

Rate of interest for the first year (R_1) = 8%

Rate of interest for the second year (R_2) = 10%

Rate of interest for the third year (R_3) = 12%

Compound amount (CA) = ?

Compound interest (CI) = ?

According to the formula, compound amount

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

$$= 2{,}00{,}000\left(1 + \frac{8}{100}\right)\left(1 + \frac{10}{100}\right)\left(1 + \frac{12}{100}\right)$$

$$= 2{,}00{,}000\left(\frac{108}{100}\right)\left(\frac{110}{100}\right)\left(\frac{112}{100}\right)$$

= Rs. 2,66,112

Thus, compound interest (CI) = CA – P = Rs. 2,66,1112 – Rs. 2,00,000 = Rs. 66,112

Example 7

A sum amounts to Rs. 14,520 in 2 years and Rs. 15,972 in 3 years at a certain rate of annual compound interest. Then,

(a) Find the rate of compound interest.

(b) Find what is the principal.

Solution

Here,

Rate of interest (R) = R% and Principal (P) = Rs. x

Case I:

Compound amount (CA_1) = Rs. 14,520

Time (T) = 2 years

Using the formula, compound amount $(CA_1) = P\left(1 + \frac{R}{100}\right)^T$

$$\text{Rs.}14{,}520 = x\left(1 + \frac{R}{100}\right)^2 \quad \text{.....(i)}$$

Case II:

Compound amount (CA_2) = Rs. 15,972

Time (T) = 3 years

Using the formula, compound amount $(CA_2) = P\left(1 + \frac{R}{100}\right)^T$

$$\text{Rs. } 15{,}972 = x\left(1 + \frac{R}{100}\right)^3 \quad \text{.....(ii)}$$

Dividing equation (ii) by (i), we get

$$\text{or, } \frac{15{,}972}{14{,}520} = \frac{x\left(1 + \frac{R}{100}\right)^3}{x\left(1 + \frac{R}{100}\right)^2}$$

$$\text{or, } 1.10 = 1 + \frac{R}{100}$$

$$\text{or, } 1.10 - 1 = \frac{R}{100}$$

$$\text{or, } 0.10 \times 100 = R$$

$$\text{or, } R = 10\%$$

$\therefore$ Rate of interest (R) = 10% p.a.

Again, putting (R) = 10% in equation (i), we get

$$14520 = x\left(1 + \frac{R}{100}\right)^2$$

or, $14520 = x\left(1 + \frac{10}{100}\right)^2$

or, $14520 = x \times 1.21$

or, $\frac{14520}{1.21} = x$

$x = 12000$

$\therefore$ Principal (P) = x = Rs. 12,000

Alternatively,

Compound amount of 2 years (CA_1) = Rs. 14,520

or, $P\left(1 + \frac{R}{100}\right)^2$ = Rs. 14,520

$x\left(1 + \frac{R}{100}\right)^2$ = Rs. 14,520 .....(i)

Again, compound amount of 3 years (CA_2) = Rs. 15,972

or, $P\left(1 + \frac{R}{100}\right)^3$ = Rs. 15,972

or, $x\left(1 + \frac{R}{100}\right)^3$ = 15,972 .....(ii)

From the equation (i) and (ii)

or, $x\left(1 + \frac{R}{100}\right)^2\left(1 + \frac{R}{100}\right) = 15,972$

$14,520\left(1 + \frac{R}{100}\right) = 15,972$ [from the equation (i)]

or, $\left(1 + \frac{R}{100}\right) = \frac{15,972}{14,520}$

or, $1 + \frac{R}{100} = 1.10$

or, $\frac{R}{100} = 1.10 - 1$

or, $R = 0.10 \times 100$

$\therefore$ R = 10% p.a.

Now, putting R = 10% in the equation (i), we get

$$x\left(1+\frac{10}{100}\right)^2 = \text{Rs. } 14{,}520$$

$$\text{or, } x\left(\frac{110}{100}\right)^2 = 14{,}520$$

$$\text{or, } x \times 1.21 = 14{,}520$$

$$\text{or, } x = \frac{14{,}520}{1.21}$$

$\therefore$ Principal (P) = Rs. 12,000 and rate of interest (R) = 10% p.a.

Example 8

A person deposited Rs. 2,00,000 in a development bank for 2 years to get the half yearly compound interest at the rate of 10% per annum after deducting the 5% tax on the interest. But right after a year, bank has changed the policy and decided to accomplish the interest terminally at the same rate of interest.

(a) Find the interest of the first year by deducting the tax.

(b) What would be the interest of the second year after deducting the tax?

(c) What is the difference between interests of the first year and second year after deducting the tax? Find.

(d) After deducting the tax, by what percentage the interest of the first year differ from the interest of the second year?

Solution

Here, principal (P) = रु. 2,00,000

Rate of interest (R) =10% p.a.

(a) For the first year, the half yearly compound interest

$$CI_1 = P\left[\left(1+\frac{R}{200}\right)^{2T} - 1\right]$$

$$= 200000\left[\left(1+\frac{10}{200}\right)^{2\times T} - 1\right]$$

$$= 2{,}00{,}000\left[\left(\frac{210}{200}\right)^{2\times 1} - 1\right]$$

$= 2,00,000\ [1.1025 - 1]$

$= 2,00,000 \times 0.1025 = \text{Rs. } 20,500$

After deducting 5% tax, $CI_1 = \text{Rs. } 20,500 - \text{Rs. } 20,500 \times \frac{5}{100}$

$= \text{Rs. } 20500 - \text{Rs. } 1025 = \text{Rs. } 19,475$

$\therefore$ Interest of the first year after deducting tax is Rs. 19,475

(b) Compound amount after a year (CA) = Rs. 2,00,000 + Rs. 19,475 = Rs. 2, 19, 475

Now, principal for the second year = compound amount of the first year = Rs. 2, 19, 475

According to the quarterly compound interest, $(CI_2) = P\left[\left(1 + \frac{R}{400}\right)^{4T} - 1\right]$

$= 2,19,475\left[\left(1 + \frac{10}{400}\right)^{4\times1} - 1\right]$

$= 2,19,475\ [0.1038128906]$

$= 22,784.33$

$= 22,784.33$

Again, the interest after deducting 5% tax $CI_2 = 22,784.33 - 22,784.33 \times \frac{5}{100}$

$= 22,784.33 - 1,139.21$

$= \text{Rs. } 21,645.12$

$\therefore$ The interest after deducting 5% tax is Rs. 21,645.12

(c) The difference in interests $= CI_2 - CI_1 = 21,645.12 - 19,475$

$= \text{Rs. } 2170.12$

(d) The difference of interests in percentage $= \frac{CI_2 - CI_1}{CI_1} \times 100\%$

$= \frac{2170.12}{19475} \times 100\% = 11.14\%$

Thus, the interest of the second year differs by 11.14% than that of the first year.

Example 9

A commercial bank releases a loan of Rs. 52,500 to Babulal and Jibanlal at the rate of yearly 10% compound interest. If the compound amount paid by Babulal in 2 years is the same as the compound amount paid by Jibanlal in 3 years, how much loan did each of them borrow from the bank?

Solution

Let, the loan amount of Babulal (P_1) = Rs. x

The loan amount of Jibanlal (P_2) = Rs. $(52{,}500 - x)$

Here, the compound amount to be paid by Babulal in 2 years

$$CA_1 = P_1\left(1 + \frac{R}{100}\right)^T$$

$$= x\left(1 + \frac{10}{100}\right)^2$$

$$= x\left(\frac{110}{100}\right)^2$$

$$= 1.21x$$

Similarly, the compound amount to be paid by Jibanlal in 3 years

$$CA_2 = P_2\left(1 + \frac{R}{100}\right)^T$$

$$= (52{,}500 - x)\left(1 + \frac{10}{100}\right)^3$$

$$= (52{,}500 - x)\left(\frac{110}{100}\right)^3$$

$$= (52{,}500 - x)\ 1.331$$

$$= 69{,}877.5 - 1.331x$$

Now, according to the question,

$$CA_1 = CA_2$$

$$1.21x = 69{,}877.5 - 1.331x$$

$$\text{or, } 1.21x + 1.331x = 69877.5$$

$$\text{or, } 2.541x = 69{,}877.5$$

$$\therefore x = 27{,}500$$

Thus, Babulal borrowed Rs. 27,500 and Jibanlal borrowed Rs. (52,500 – 27,500) = Rs. 25000.

Exercise 2.1

1. Define:

(a) Yearly compound interest (b) Half yearly compound interest

(c) Quarterly compound interest

2. (a) According to the yearly compound interest, if principal is P, yearly rate of interest is R and time is T years, write the formula to compute compound amount.

(b) The compound interest CI of a sum P in T years at the rate of yearly compound interest is R%, write the relation between P, T, R and CI.

(c) Employee Provident Fund changes the rate of interest per annum according to the economic liquidity of the state. As per the given condition the compound amount of a sum P at the intrest rate of R_1%, R_2% and R_3% for the first, second and third years respectively is CA, then write the formula to find CA.

3. Without using formula, find the compound interest and compound amount for the following conditions:

(a) Principal (P) = Rs. 10,000, Time (T) = 2 years and Rate of interest (R) = 6 % p.a.

(b) Principal (P) = Rs. 64,000, Time (T) = 3 years and Rate of interest (R) = 6% p.a.

(c) Principal (P) = Rs. 20,000, Time (T) = 2 years, Rate of interest for the first year (R_1) = 10% p.a. and the rate of interest for the second year (R_2) = 12% p.a.

4. (a) At what rate of compound interest per year will the compound interest of Rs. 100 in a year be Rs. 12? Write.

(b) At what rate of compound interest per year will the compound interest of Rs. 200 in 2 years be Rs. 42? Find it.

5. (a) A farmer borrowed Rs. 20,000 from a co-operative to invest in poultry farm for 3 years at the rate of compound interest of 15% per year. Find the compound interest and compound amount of 3 years.

(b) A teacher deposited Rs. 50,000 in a bank at the account of his daughter. If the bank provides yearly 10% interest, what will be the compound interest and compound amount in 3 years? Find.

(c) Sabita deposited Rs. 1,50,000 in a bank. If the bank provides yearly 6% interest after 2 years 6 months,

(i) how much is the compound amount?

(ii) how much is the compound interest?

6. (a) Manisha deposited Rs. 50,000 in a bank at the rate of compound interest 8% p.a. If the bank provides half yearly compound interest, then find the compound interest and compound amount she receives after 2 years.

(b) A bank provides quarterly compound interest. If Sunil deposited Rs. 50,00,000 for 1 year at the rate of 12% p.a. interest, then find the compound interest and compound amount.

7. (a) Karma Gurung deposited Rs. 80,000 in a bank at the rate of 8% compound interest 8% p.a. Find the difference between simple interest and compound interest of the sum in 2 years.

(b) Find the difference between simple interest and yearly compound interest of a sum Rs. 7,500 at the rate of 12% p.a. intrest in 3 years.

8. (a) Chhiring deposited Rs. 40,000 at the rate of 6% annual compound interest. Find the difference of yearly compound interest and half yearly compound interest of the sum in 2 years.

(b) What is the difference between semi-annual compound interest and quarterly compound interest of Rs. 18,000 in a year at the rate of 12% compound interest p. a.? Find it.

(c) You went to deposit Rs. 60,000 in a bank for 2 years. The information in the notice board of the bank is given below:

Notice for the interest of deposit collection It is notified that two types of fixed deposit accounts are going to be effective from 2079/01/01. Grab the opportunity that of fixed deposit in time.	
Fixed deposit (P)	**Fixed deposit (Q)**
Rate of half yearly compound interest 10% p.a.	Rate of yearly compound interest 12% p.a.

(i) How much interest will be collected in account (P) after 2 years?

(ii) How much interest will be collected in account (Q) after 2 years?

(iii) After knowing the interest rates of both options, by which option will you deposit the money? And why?

9. (a) If the yearly compound interest of a sum in 2 years at the rate of 15% p.a. interest is Rs. 180 more than simple interest, then find the sum.

(b) If the half yearly compound interest of a sum in a year at the rate of 10% interest p.a. is Rs. 40 more than the yearly compound interest of the same sum for the same period of time at the same rate of interest, then find the sum.

(c) Suprim borrowed some money for 2 years at the rate of compound interest of 10% p.a. and immediately he lent the money at the same rate of half yearly compound interest for the same period of time. In this transaction, if he gained Rs. 2019.24, then find how much he borrowed?

10. (a) In how many years, a sum of Rs. 1,00,000 amounts to Rs. 1,21,000 at the rate of compound interest 10% p.a.?

(b) According to the compound interest, in how many years will the compound interest of Rs. 8,00,000 at the rate of 10% p.a. be Rs. 12,61,000? Find it.

(c) At what rate of yearly compound interest, the sum of Rs. 700 amounts to Rs. 847 in 2 years?

(d) At what rate of annual compound interest will the compound interest of Rs. 3,43,000 in 3 years be Rs. 1,13,533? Find.

11. (a) At the rate of yearly compound interest, a sum will be Rs. 6,050 in 2 years and Rs. 6,655 in 3 years respectively then
(i) find the rate of the compound interest. (ii) find the sum.

(b) At the rate of annual compound interest, a sum amounts to Rs. 10,580 in 2 years and Rs. 12,167 in 3 years respectively, then
(i) find the rate of the compound interest.
(ii) find the sum.

(c) The compound interest of a sum at the rate of yearly compound interest in 1 year and 2 years are respectively Rs. 1,800 and Rs. 3,816, then find the rate of the interest and the sum.

12. (a) A person deposited Rs. 5,00,000 interest received from a commercial bank for 2 years to get the half yearly compound interest at the rate of 10% per annum. 5% tax on the interest will be levied. But right after a year, the bank has changed the policy and decided to accomplish the interest quarterly at the same rate of interest.

(i) Find the interest of the first year by deducting the tax.

(ii) What would be the interest of the second year be after deducting the tax?

(iii) What is the difference between the interest of the first year and second year after deducting the tax? Find.

(iv) After deducting the tax, by what percentage the interest of the first year differ from the interest of the second year?

(b) A person deposited Rs. 80,000 in a co-operative limited for 2 years to get the yearly compound interest at the rate of 15% per annum after deducting the 5% tax on the interest.

But right after a year, the bank has changed the policy and decided to accomplish the interest half yearly at the same rate of interest. After deducting tax, by what percentage the interest of the first year differ from the interest of the second year?

13. (a) Ram divided Rs. 41,000 in two parts and deposited in the bank account of two daughters at the rate of annual compound interest 5% for 2 years and 3 years respectively. If the compound amount received by them after 2 years and 3 years respectively are equal, find how much did each of them get?

b) Divide Rs. 21,000 in two parts in such a way that the compound amount of the first part at the rate of 10% p.a. for 3 years is equal to the compound amount for 2 years. What sums are there in the first part and the second part? Find it.

14. a) According to the yearly compound interest, the compound interest of a sum for 1 year and 2 years are respectively Rs. 450 and Rs. 945, find the rate of interest and the sum.

b) According to the yearly compound interest, the compound interests of a sum for 1 year and 2 years are Rs. 1800 and Rs. 3816 respectively. Find the rate of the interest and the sum.

Project work

Visit a co-operative or bank or financial institution in your surroundings. Get information about various plannings by visiting head of the institution or receptionist or any other who can give information. If you find the brochure of the institution, study the various schemes. If your father or mother or any other family member is intrested to deposit a sum of money, which scheme do you prefer? Why? Prepare a report with your reason and present the report in your classroom.

Answer

3. (a) Rs. 1,236 and Rs.11,236 (b) Rs. 12,225.02 and Rs. 76,225.02
   (c) Rs. 4,640 and Rs. 24,640
4. (a) 12% (b) 10%
5. (a) Rs. 10,417.50 and Rs. 30417.50 (b) Rs. 16,550 and Rs. 66,550
   (c) Rs. 1,72,753.50 and Rs. 22,753.50
6. (a) Rs. 58492.93 and Rs. 8492.93 (b) Rs. 5627,544.05 and Rs. 627, 544.05
7. (a) Rs. 512 (b) Rs. 336.96

8. (a) Rs. 76.35 (b) Rs. 34.36 (c) (i) Rs. 12930.37

(ii) Rs. 15264 (iii) Rs. 2333.62 more interest in account Q

9. (a) Rs. 8,000 (b) Rs. 16,000 (c) Rs. 366717.82

10. (a) 2 year (b) 3 years (c) 10% (d) 10%

11. (a) (i) 10% (ii) Rs. 5,000

(b) (i) 15% (ii) Rs. 8,000 (c)12% Rs. 15,000

12. (a) (i) Rs. 48,687.5 (ii) 54112.79

(iii) 5425.2936 (iv) 11.14% (b) 18.53%

13. (a) Rs. 21,000 and Rs. 20,000 (b) Rs.10,000 and Rs.11,000

14. (a)10% and Rs. 4,500 (b)12% and Rs.1,500