

Exercise 3(A)

1. Find the amount and the compound interest on ₹12,000 in 3 years at 5% compounded annually.

Solution:

Given: $P = ₹12,000$; $n = 3$ years and $r = 5\%$

We know that,

$$\begin{aligned}\text{Amount} &= P(1 + r/100)^n \\ &= 12000(1 + 5/100)^3 \\ &= 12000(21/20)^3 \\ &= ₹13,891.50\end{aligned}$$

Therefore,

$$\begin{aligned}\text{Compound Interest (C.I.)} &= ₹13,891.50 - ₹12,000 \\ &= ₹1,891.50\end{aligned}$$

2. Calculate the amount of ₹15,000 is lent at compound interest for 2 years and the rates for the successive years are 8% and 10% respectively.

Solution:

Given: $P = ₹15,000$; $n = 2$ years; $r_1 = 8\%$ and $r_2 = 10\%$

We know that,

$$\begin{aligned}\text{Amount} &= P(1 + r_1/100)(1 + r_2/100) \\ &= 15000(1 + 8/100)(1 + 10/100) \\ &= 15000(27/25)(11/10) \\ &= ₹17,820\end{aligned}$$

Therefore, the amount after 2 years is ₹17,820

3. Calculate the compound interest accrued on ₹6,000 in 3 years, compounded yearly, if the rates for the successive years are 5%, 8% and 10% respectively.

Solution:

Given: $P = ₹6,000$; $n = 3$ years; $r_1 = 5\%$; $r_2 = 8\%$ and $r_3 = 10\%$

We know that,

$$\begin{aligned}\text{Amount} &= P(1 + r_1/100)(1 + r_2/100)(1 + r_3/100) \\ &= 6000(1 + 5/100)(1 + 8/100)(1 + 10/100) \\ &= 6000(21/20)(27/25)(11/10) \\ &= ₹7,484.40\end{aligned}$$

Therefore,

$$\text{C.I.} = ₹7,484.40 - ₹6,000 = ₹1,484.40$$

4. What sum of money will amount to ₹5,445 in 2 years at 10% per annum compound interest?

Solution:

Given: Amount = ₹5,445; $n = 2$ years and $r = 10\%$

We know that,

$$\begin{aligned}A &= P(1 + r/100)^n \\5445 &= P(1 + 10/100)^2 \\5445 &= P(11/10)^2 \\P &= 5445(10/11)^2 \\&= ₹4,500\end{aligned}$$

Therefore, the principal amount is ₹4,500

5. On what sum of money will the compound interest for 2 years at 5% per annum amount to ₹768.75?

Solution:

Given: C.I. = ₹768.75; n = 2 years and r = 5%

We know that,

$$\begin{aligned}A &= P(1 + r/100)^n \\&= P(1 + 5/100)^2 \\&= P(21/20)^2 = 441P/400\end{aligned}$$

Thus,

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

$$441P/400 - P = ₹768.75$$

$$41P/400 = ₹768.75$$

$$\begin{aligned}P &= (768.75 \times 400)/41 \\&= ₹7,500\end{aligned}$$

Therefore, the initial sum is ₹7500

6. Find the sum on which the compound interest for 3 years at 10% per annum amounts to ₹1,655.

Solution:

Given: C.I. = ₹1,655; n = 3 years and r = 10%

We know that,

$$\begin{aligned}A &= P(1 + r/100)^n \\&= P(1 + 10/100)^3 \\&= P(11/10)^3 \\&= 1331P/1000\end{aligned}$$

So,

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

$$1655 = 1331P/1000 - P$$

$$1655 = 331P/1000$$

$$\begin{aligned}P &= (1655 \times 1000)/331 \\&= 5000\end{aligned}$$

Therefore, the initial sum is ₹5,000

7. What principal will amount to ₹9,856 in two years, if the rates of interest for successive years are 10% and 12% respectively?

Solution:

Given: Amount = ₹9,856; $n = 2$ years; $r_1 = 10\%$ and $r_2 = 12\%$

We know that,

$$\text{Amount} = P(1 + r_1/100)(1 + r_2/100)$$

$$9856 = P(1 + 10/100)(1 + 12/100)$$

$$9856 = P(11/10)(28/25)$$

So,

$$P = (9856 \times 10 \times 25)/(11 \times 28) \\ = 8000$$

Therefore, the principal is ₹8,000

8. On a certain sum, the compound interest in 2 years amounts to ₹4,240. If the rate of interest for the successive years is 10% and 15% respectively, find the sum.

Solution:

Given: C.I. = ₹4,240; $n = 2$ years; $r_1 = 10\%$ and $r_2 = 15\%$

We know that,

$$A = P(1 + r_1/100)(1 + r_2/100)$$

Now,

$$A = P + \text{C.I.}$$

So,

$$(P + 4240) = P(1 + 10/100)(1 + 15/100)$$

$$(P + 4240) = P(11/10)(23/20)$$

$$P + 4240 = P(1.265)$$

$$1.265P - P = 4240$$

$$P = 4240/0.265$$

$$= 16000$$

Therefore, the initial sum is ₹16,000

9. At what per cent per annum will ₹6,000 amount to ₹6,615 in 2 years when interest is compounded annually?

Solution:

Given: $P = ₹6000$; $A = ₹6,615$ and $n = 2$ years

We know that,

$$A = P(1 + r/100)^n$$

$$6615 = 6000(1 + r/100)^2$$

$$(1 + r/100)^2 = 6615/6000$$

$$(1 + r/100)^2 = 1.1025$$

Taking square root on both sides, we get

$$(1 + r/100) = 1.05$$

$$1 + r/100 = 21/20$$

$$r/100 = 21/20 - 1$$

$$r/100 = 1/20$$

$$r = 5$$

Therefore, the rate of compound interest is 5%

10. At what rate per cent compound interest, does a sum of money become 1.44 times of itself in 2 years?

Solution:

Let's assume the principal to ₹y

Then, the amount will be ₹1.44y

And, $n = 2$ years

We know that,

$$A = P(1 + r/100)^n$$

$$1.44y = y(1 + r/100)^2$$

$$1.44y/y = (1 + r/100)^2$$

$$1.44 = (1 + r/100)^2$$

Taking square root on both sides, we get

$$1 + r/100 = 1.2$$

$$r/100 = 1.2 - 1 = 0.2$$

$$r/100 = 2/10$$

$$r = 20$$

Therefore, the rate of compound interest is 20%

11. At what rate per cent will a sum of ₹4,000 yield ₹1,324 as compound interest in 3 years?

Solution:

Given: $P = ₹4,000$; C.I. = ₹1,324 and $n = 3$

Now, $A = P + \text{C.I.}$

So,

$$A = ₹4,000 + ₹1,324 = ₹5,324$$

We know that,

$$A = P(1 + r/100)^n$$

$$5324 = 4000(1 + r/100)^3$$

$$5324/4000 = (1 + r/100)^3$$

$$1331/1000 = (1 + r/100)^3$$

Taking cube root on both sides, we get

$$11/10 = (1 + r/100)$$

$$r/100 = 11/10 - 1$$

$$r/100 = 1/10$$

$$r = 10$$

Therefore, the rate of compound interest is 10%

12. A person invests ₹5,000 for three years at a certain rate of interest compounded annually. At the end of two years this sum amounts to ₹6,272. Calculate:

(i) the rate of interest per annum.

(ii) the amount at the end of the third year.

Solution:

Given: $P = ₹5,000$; $A = ₹6,272$ and $n = 2$ years

(i) We know that,

$$A = P(1 + r/100)^n$$

$$6272 = 5000(1 + r/100)^2$$

$$6272/5000 = (1 + r/100)^2$$

$$784/625 = (1 + r/100)^2$$

$$(28/25)^2 = (1 + r/100)^2$$

Taking square root on both side, we get

$$28/25 = 1 + r/100$$

$$r/100 = 28/25 - 1 = 3/25$$

$$r = (3 \times 100)/25$$

Thus, $r = 12\%$

(ii) Amount at the third year

$$A = 5000(1 + 12/100)^3$$

$$= 5000(28/25)^3$$

Therefore,

$$A = ₹7,024.64$$

13. In how many years will ₹7,000 amount to ₹9,317 at 10% per annum compound interest?

Solution:

Given: $P = ₹7,000$; $A = ₹9,317$ and $r = 10\%$

We know that,

$$A = P(1 + r/100)^n$$

$$9317 = 7000(1 + 10/100)^n$$

$$9317/7000 = (11/10)^n$$

$$1331/1000 = (11/10)^n$$

$$(11/10)^3 = (11/10)^n$$

On comparing, we have

$$n = 3$$

Therefore, the number of years is 3

14. Find the time, in years, in which Rs4,000 will produce Rs630.50 as compound interest at 5% compounded annually.

Solution:

Given: $P = ₹4,000$; C.I. = ₹630.50 and $r = 5\%$

We know that,

$$C.I. = P[(1 + r/100)^n - 1]$$

$$630.50 = 4000[(1 + 5/100)^n - 1]$$

$$630.50/4000 = (1 + 5/100)^n - 1$$

$$1261/8000 = (21/20)^n - 1$$

$$1261/8000 + 1 = (21/20)^n$$

$$9261/8000 = (21/20)^n$$

$$(21/20)^3 = (21/20)^n$$

On comparing, we have

$$n = 3$$

Therefore, the time in years is 3

15. Divide ₹28,730 between A and B so that when their shares are lent out at 10% compound interest compounded per year, the amount that A receives in 3 years is the same as what B receives in 5 years.

Solution:

Let's assume the share of A as ₹y

$$\text{Share of B} = ₹(28,730 - y)$$

Rate of interest = 10%

Then, according to question

Amount of A in 3 years = Amount of B in 5 years

$$y(1 + 10/100)^3 = (28730 - y)(1 + 10/100)^5$$

$$y = (28730 - y)(1 + 10/100)^2$$

$$y = (28730 - y)(11/10)^2$$

$$y = (121/100)(28730 - y)$$

$$100y = 121(28730 - y)$$

$$100y = 121 \times 28730 - 121y$$

$$221y = (121 \times 28730)$$

$$y = (121 \times 28730) / 221$$
$$= 15730$$

Therefore, the share of A = ₹15,730 and share of B = ₹28,730 - ₹15,730 = ₹13,000

16. A sum of ₹44,200 is divided between John and Smith, 12 years and 14 years old respectively, in such a way that if their portions be invested at 10% per annum compound interest, they will receive equal amounts on reaching 16 years of age.

(i) What is the share of each out of ₹44,200?

(ii) What will each receive, when 16 years old?

Solution:

(i) Let's assume the share of John = ₹y

So, the share of Smith = ₹(44,200 - y)

Rate of interest = 10%

According to question, we have

Amount of John in 4 years = Amount of Smith in 2 years

$$y(1 + 10/100)^4 = (44200 - y)(1 + 10/100)^2$$

$$y(1 + 10/100)^2 = (44200 - y)$$

$$y(11/10)^2 = (44200 - y)$$

$$121y/100 = (44200 - y)$$

$$121y = 100(44200 - y)$$

$$121y + 100y = 4420000$$

$$221y = 4420000$$

$$y = 20000$$

Therefore, share of John = ₹20,000 and
Share of Smith = ₹44,200 - ₹20,000 = ₹24,200

$$\begin{aligned} \text{(ii) Amount that each will receive} \\ &= 20000(1 + 10/100)^4 \\ &= 20000(11/10)^4 \\ &= 29282 \end{aligned}$$

Therefore, the amount that each will receive is ₹29,282

17. The simple interest on a certain sum of money and at 10% per annum is ₹6,000 in 2 years, Find:

(i) the sum.

(ii) the amount due to the end of 3 years and at the same rate of interest compounded annually.

(iii) the compound interest earned in 3 years.

Solution:

(i) Given: S.I. = ₹6000; n = 2 years and R = 10%

We know that,

$$I = PTR/100$$

So,

$$\begin{aligned} P &= (I \times 100)/(R \times T) \\ &= (6000 \times 100)/(10 \times 2) \\ &= 30000 \end{aligned}$$

Thus, the sum of money is ₹30,000

(ii) Now, P = ₹30,000; n = 3 years and r = 10%

We know that,

$$\begin{aligned} A &= P(1 + r/100)^n \\ &= 30000(1 + 10/100)^3 \\ &= 30000(11/10)^3 \\ &= 30 \times 11^3 \\ &= 39930 \end{aligned}$$

Thus, the amount is ₹39,930

(iii) The C.I. earned in 3 years = A - P = ₹39,930 - ₹30,000 = ₹9,930

18. Find the difference between compound interest and simple interest on ₹8,000 in 2 years and at 5% per annum.

Solution:

Given: P = ₹8000, R = 5% and T = 2 years

To calculate simple interest,

$$\begin{aligned} \text{S.I.} &= (P \times R \times T)/100 \\ &= (8000 \times 5 \times 2)/100 \\ &= ₹800 \end{aligned}$$

To calculate compound interest,

$$\begin{aligned}A &= P(1 + r/100)^n \\&= 8000(1 + 5/100)^2 \\&= 8000(105/100)^2 \\&= 8000(21/20)^2 \\&= 8820\end{aligned}$$

Thus, the amount is ₹8820

So,

$$\begin{aligned}\text{C.I.} &= A - P \\&= ₹(8820 - 8000) \\&= ₹820\end{aligned}$$

Thus, the compound interest is ₹820



Exercise 3(B)

1. The difference between simple interest and compound interest on a certain sum is ₹54.40 for 2 years at 8 per cent per annum. Find the sum.

Solution:

Let's assume the principal (P) = x

R = 8%

T = 2 years

Now,

The simple interest is calculated as

$$\begin{aligned} \text{S.I.} &= (x \times 8 \times 2)/100 \\ &= 4x/25 \end{aligned}$$

The compound interest is calculated as

$$\begin{aligned} \text{C.I.} &= A - P \\ &= x(1 + 8/100)^2 - x \\ &= x[(1 + 2/25)^2 - 1] \\ &= x[(27/25)^2 - 1] \\ &= 104x/625 \end{aligned}$$

Given, C.I. = S.I. = 54.40

$$104x/625 - 4x/25 = 54.40$$

$$x(104/625 - 4/25) = 54.40$$

$$x(104/625 - 100/625) = 54.40$$

$$x(4/625) = 54.40$$

$$\begin{aligned} x &= (54.40 \times 625)/4 \\ &= 8500 \end{aligned}$$

Thus, the principal sum is ₹8,500

2. A sum of money, invested at compound interest, amounts to ₹19,360 in 2 years and to ₹23,425.60 in 4 years. Find the rate per cent and the original sum of money.

Solution:

Given: Amount after 2 years = ₹19360; So, n = 2 years and

Amount after 4 years = ₹23,425.60; So, n = 4

Let's assume the principal as X and the rate of C.I. as R

Now, we have

$$X(1 + R/100)^2 = 19360 \dots (1)$$

And,

$$X(1 + R/100)^4 = 23425.60 \dots (2)$$

Performing (2) ÷ (1), we have

$$\begin{aligned} (1 + R/100)^2 &= 23425.60/19360 \\ &= 2342560/1936000 \\ &= 14641/12100 \\ &= (121/110)^2 \end{aligned}$$

Now, taking square root on both sides we get

$$(1 + R/100) = 121/110$$

$$R/100 = 121/110 - 1$$

$$R = (11/110) \times 100 \\ = 10$$

Therefore, the rate of C.I. is 10%

Now,

Form (1), we have

$$X(1 + 10/100)^2 = 19360$$

$$X(11/10)^2 = 19360$$

$$X = (19360 \times 10 \times 10) / (11 \times 11) \\ = 16000$$

Thus, the principal sum is ₹16,000

3. A sum of money lent out at C.I. at a certain rate per annum becomes three times of itself in 8 years. Find in how many years will the money becomes twenty-seven times of itself at the same rate of interest p.a.

Solution:

Let's assume the principal as x

Amount (A) = 3x, n = 8 years, R = ?

We know that,

$$A = P(1 + R/100)^n$$

Now,

Case I:

$$3x = x(1 + R/100)^8$$

Taking the 8th root on both sides, we have

$$3^{1/8} = (1 + R/100) \dots (1)$$

Case II:

$$P = x, A = 27x, T = ?$$

$$27x = x(1 + R/100)^T$$

$$27^{1/T} = 1 + R/100 \dots (2)$$

From (1) and (2), we have

$$3^{1/8} = 27^{1/T}$$

$$3^{1/8} = (3^3)^{1/T}$$

$$3^{1/8} = 3^{3/T}$$

On comparing the exponents,

$$1/8 = 3/T$$

$$T = 3 \times 8 = 24$$

Thus, it will take 24 years for the money to become twenty-seven times of itself at the same rate of interest p.a.

4. On what sum of money will compound interest (payable annually) for 2 years be the same as simple interest on ₹9,430 for 10 years, both at the rate of 5 per cent per

annum?

Solution:

Given: $P = ₹9430$, $R = 5\%$ and $n = 10$ years

Now, the simple interest is calculated as

$$SI = PNR/100$$

$$SI = (943 \times 5 \times 10)/100 \\ = ₹4,715$$

Now, let's assume a sum(principal) x

We have,

$$CI = ₹4,715; T = 2 \text{ years and } R = 5\%$$

We know that,

$$CI = A - P$$

$$4715 = x(1 + R/100)^T - x \\ = x(1 + 5/100)^2 - x \\ = x[(21/20)^2 - 1] \\ = x[(441 - 400)/400] \\ = 41x/400$$

$$x = (4715 \times 400)/41 \\ = 46000$$

Thus, the principal sum is ₹46,000

5. Kamal and Anand each lent the same sum of money for 2 years at 5% at simple interest and compound interest respectively. Anand received ₹15 more than Kamal. Find the amount of money lent by each and the interest received.

Solution:

Let's assume the principal as Rs. 100, $R = 5\%$ and for $T = 2$ years

Then,

For Kamal,

$$SI = (100 \times 5 \times 2)/100 \\ = ₹10$$

And,

For Anand,

$$A = P(1 + R/100)^T \\ = 100(1 + 5/100)^T \\ = 100(21/20)^2 \\ = ₹441/4$$

So,

$$CI = 441/4 - 100 \\ = (441 - 400)/4 \\ = ₹41/4$$

$$\text{The difference of CI and SI} = 41/4 - 10 \\ = (41 - 40)/4 \\ = ₹1/4$$

Now,

When the difference is ₹1/4, the principal is ₹100

So,

If the difference is 1, the principal = 100×4
= ₹400

And if the difference is Rs, 15, the principal = $100 \times 4 \times 15$
= ₹6000

Hence,

For Kamal, interest = $(6000 \times 5 \times 2)/100$
= ₹600

For Anand, interest = $6000 (1 + 5/100)^2 - 6000$
= $6000 [(21/20)^2 - 1]$
= $6000 (441/400 - 1)$
= $6000 (41/400)$
= ₹615

6. Simple interest on a sum of money for 2 years at 4% is ₹450. Find compound interest of the same sum and at the same rate for 2 years.

Solution:

Given: SI = Rs. 450; R = 4%; T = 2 years

Now,

$$\begin{aligned} P &= (SI \times 100)/(R \times T) \\ &= (450 \times 100)/(4 \times 2) \\ &= ₹5,625 \end{aligned}$$

Now, P = ₹5,625, R = 4% and T = 2 years

So, the amount is calculated as

$$\begin{aligned} A &= 5625(1 + 4/100)^2 \\ &= 5625(26/25)^2 \\ &= 3802500/625 \\ &= ₹6084 \end{aligned}$$

Hence,

$$\begin{aligned} CI &= A - P \\ &= 6084 - 5625 \\ &= ₹459 \end{aligned}$$

7. Simple interest on a certain sum of money for 4 years at 4% per annum exceeds the compound interest on the same sum for 3 years at 5 percent per annum by ₹228. Find the sum.

Solution:

Let's consider the principal as P,

Given: R = 4% and T = 4 years for simple interest and R = 5% and T = 3 years for compound

interest

Now,

$$\begin{aligned}SI &= (P \times 4 \times 4)/100 \\ &= 4P/25\end{aligned}$$

And,

$$\begin{aligned}CP &= P (1 + 5/100)^3 - P \\ &= P [(21/20)^3 - 1] \\ &= P (9261/8000 - 1) \\ &= 1261P/8000\end{aligned}$$

Given: $SI - CI = ₹228$

So,

$$\begin{aligned}4P/25 - 1261P/8000 &= 228 \\ (4 \times 320P - 1261P)/8000 &= 228 \\ 19P &= 228 \times 8000 \\ P &= (228 \times 8000)/19 \\ &= 96000\end{aligned}$$

Thus, the principal sum is ₹96000

8. Compound interest on a certain sum of money at 5% per annum for two years is ₹246. Calculate simple interest on the same sum for 3 years at 6% per annum.

Solution:

Given: $CI = ₹246$, $R = 5\%$ and $T = 2$ years

$$CI = A - P$$

$$246 = P (1 + 5/100)^2 - P$$

$$246 = P [(21/20)^2 - 1]$$

$$246 = P (41/400)$$

$$\begin{aligned}P &= (246 \times 400)/41 \\ &= 2400\end{aligned}$$

Now, $P = ₹2400$, $R = 6\%$ and $T = 3$ years

$$\begin{aligned}SI &= (2400 \times 6 \times 3)/100 \\ &= ₹432\end{aligned}$$

Hence, the simple interest is ₹432

9. A certain sum of money amounts to ₹23,400 in 3 years at 10% per annum simple interest. Find the amount of the same sum in 2 years and at 10% p.a. compound interest.

Solution:

Let's the sum (principle) as x

Given: Amount = ₹23,400; $R = 10\%$ and $T = 3$ years

Now,

$$\begin{aligned}SI &= (x \times 10 \times 3)/100 \\ &= 3x/10\end{aligned}$$

We know that,

Amount = Principle + Interest

$$23400 = x + 3x/10$$

$$234000 = (10x + 3x)$$

$$x = 234000/13$$

$$x = 18000$$

Now,

Principle = ₹18000, R = 10% and n = 2 years

So,

$$A = P (1 + R/100)^n$$

$$= 18000 (1 + 10/100)^2$$

$$= 18000 (11/10)^2$$

$$= 18000 (121/100)$$

$$= 21780$$

Hence, the amount is ₹21,780

10. Mohit borrowed a certain sum at 5% per annum compound interest and cleared this loan by paying ₹12,600 at the end of the first year and ₹17,640 at the end of the second year. Find the sum borrowed.

Solution:

Let's assume the principal sum to be P

Now,

For the payment of ₹12,600 at the end of the first year, we have

$$A = ₹12,600; R = 5\% \text{ and } n = 1 \text{ year}$$

So,

$$A = P(1 + R/100)^n$$

$$12600 = P(1 + 5/100)^1$$

$$12600 = P(21/20)$$

$$P = (12600 \times 20)/21$$

$$= ₹12,000$$

Now, for the payment of ₹17,640 at the end of second year

$$A = ₹17,640; R = 5\% \text{ and } n = 2 \text{ years}$$

We know that,

$$A = P(1 + R/100)^n$$

$$17640 = P(1 + 5/100)^2$$

$$17640 = P(21/20)^2$$

$$P = (20/21)^2 \times 17640$$

$$= 16000$$

Thus, the sum borrowed = ₹(12,000 + 16,000) = ₹28,000

Exercise 3(C)

1. If the interest is compounded half-yearly, calculate the amount when principal is ₹7,400; the rate of interest is 5% per annum and the duration is one year.

Solution:

Given: $P = ₹7,400$; $r = 5\%$ p.a. and $n = 1$ year

As the interest is compounded half-yearly, we have

$$\begin{aligned}A &= P [1 + r/(2 \times 100)]^{n \times 2} \\&= 7400 [1 + 5/(2 \times 100)]^{1 \times 2} \\&= 7400 (1 + 1/40)^2 \\&= 7400 (41/40)^2 \\&= 7774.63\end{aligned}$$

Hence, the amount is ₹7,774.63

2. Find the difference between the compound interest compounded yearly and half-yearly on ₹10,000 for 18 months at 10% per annum.

Solution:

Given: $P = ₹10,000$; $n = 18$ months = $1\frac{1}{2}$ year and $r = 10\%$ p.a.

Now,

(i) When interest is compounded yearly

For 1 year,

$$\begin{aligned}A &= P(1 + r/100)^n \\&= 10000 (1 + 10/100)^1 \\&= 10000 (11/10) \\&= 11000\end{aligned}$$

Hence, after the first year the amount is ₹11,000

For $\frac{1}{2}$ year,

$P = ₹11,000$; $n = \frac{1}{2}$ year and $r = 10\%$

$$\begin{aligned}A &= P[1 + r/(2 \times 100)]^{n \times 2} \\&= 11000 [1 + 10/(2 \times 100)]^{1/2 \times 2} \\&= 11000 (21/20)^1 \\&= 11550\end{aligned}$$

So, after $1\frac{1}{2}$ year the amount is ₹11,550

Hence, the C.I = ₹11,550 – ₹10,000 = ₹1,550

(ii) When interest is compounded half-yearly

$$\begin{aligned}A &= P [1 + r/(2 \times 100)]^{n \times 2} \\&= 10000[1 + 10/(2 \times 100)]^{3/2 \times 2} \\&= 10000(21/20)^3 \\&= 11,576.25\end{aligned}$$

Hence, after $1\frac{1}{2}$ years the amount when compounded half-yearly is ₹11,576.25

So,

C.I = ₹11,576.25 – ₹10,000 = ₹1,576.25

Therefore, the difference between both C.I = ₹1,576.25 – ₹1,550
= ₹26.25

3. A man borrowed Rs.16,000 for 3 years under the following terms:

(i) 20% simple interest for the first 2 years.

(ii) 20% C.I. for the remaining one year on the amount due after 2 years, the interest being compounded half-yearly.

Find the total amount to be paid at the end of the three years.

Solution:

Given: P = ₹16,000; N = 3 years

For the first 2 years, R = 20%

So,

$$\begin{aligned} \text{S.I} &= (P \times N \times R)/100 \\ &= (16000 \times 2 \times 20)/100 \\ &= 6400 \end{aligned}$$

Hence, the amount after 2 year will be (P + S.I) = ₹(16,000 + 6400) = ₹22,400

This is the amount at the end of 2 years.

Now, for the remaining 1 year the interest is compounded half-yearly

So,

$$\begin{aligned} A &= P[1 + r/(2 \times 100)]^{n \times 2} \\ &= 22400(1 + 20/200)^2 \\ &= 22400(11/10)^2 \\ &= 27104 \end{aligned}$$

Therefore,

The total amount to be paid at the end of the three years is ₹27,104.

4. What sum of money will amount to ₹27,783 in one and a half years at 10% per annum compounded half yearly?

Solution:

Given: A = ₹27,783; N = 1½ years and R = 10% compounded half-yearly

So,

$$\begin{aligned} A &= P[1 + r/(2 \times 100)]^{n \times 2} \\ 27783 &= P[1 + 10/200]^{3/2 \times 2} \\ 27783 &= P(1 + 1/20)^3 \\ 27783 &= P(21/20)^3 \\ P &= 27783 \times (20/21)^3 \\ &= 24000 \end{aligned}$$

Therefore,

The sum of ₹24,000 amounts to ₹27,783 in one and a half years if compounded half yearly at 10% per annum.

5. Ashok invests a certain sum of money at 20% per annum, compounded yearly. Geeta invests an equal amount of money at the same rate of interest per annum compounded half-yearly. If Geeta gets ₹33 more than Ashok in 18 months, calculate the money invested.

Solution:

Let $P = \text{Rs } y$; $n = 18 \text{ months} = 1\frac{1}{2} \text{ year}$ and $r = 20\% \text{ p.a.}$

(i) For Ashok (interest is compounded yearly)

For 1 year,

$$\begin{aligned} A &= P(1 + r/100)^n \\ &= y(1 + 20/100)^1 \\ &= (6/5)y \end{aligned}$$

For $\frac{1}{2}$ year,

Now, $P = (6/5)y$; $n = \frac{1}{2} \text{ year}$ and $r = 20\%$

$$\begin{aligned} A &= P[1 + r/(2 \times 100)]^{n \times 2} \\ &= (6/5)y[1 + 20/(2 \times 100)]^{1/2 \times 2} \\ &= (66/50)y \end{aligned}$$

(ii) For Geeta (interest is compounded half-yearly)

$$\begin{aligned} A &= P[1 + r/(2 \times 100)]^{n \times 2} \\ &= y[1 + 20/(2 \times 100)]^{3/2 \times 2} \\ &= y(11/10)^3 \\ &= (1331/1000)y \end{aligned}$$

Then, according to question

$$(1331/1000)y - (66/50)y = 33$$

$$(11/1000)y = 33$$

$$y = (33 \times 1000)/11$$

$$= 3000$$

Therefore, the money invested by each person is ₹3,000

6. At what rate of interest per annum will a sum of ₹62,500 earn a compound interest of ₹5,100 in one year? The interest is to be compounded half-yearly.

Solution:

Given: $P = ₹62,500$; $C.I = ₹5100$ and $N = 1$ (compounded half-yearly)

So,

$$\begin{aligned} C.I &= P[1 + r/(2 \times 100)]^{2 \times n} - 1 \\ 5100 &= 62500[(1 + r/200)^2 - 1] \\ (1 + r/200)^2 &= 67600/62500 \\ 1 + r/200 &= 260/250 \\ r &= 8 \end{aligned}$$

Therefore, the rate of interest is 8%

7. In what time will ₹1,500 yield ₹496.50 as compound interest at 20% per year compounded half-yearly?

Solution:

Given: $P = ₹1,500$; C.I. = ₹496.50 and $r = 20\%$ (compounded semi-annually)

Then,

$$C.I. = P\left\{\left[1 + \frac{r}{(2 \times 100)}\right]^{nx2} - 1\right\}$$

$$496.50 = 1500\left\{\left[1 + \frac{20}{(2 \times 100)}\right]^{n \times 2} - 1\right\}$$

$$496.50/1500 = (11/10)^{2n} - 1$$

$$331/1000 + 1 = (11/10)^{2n}$$

$$1331/1000 = (11/10)^{2n}$$

$$(11/10)^3 = (11/10)^{2n}$$

On comparing, we get

$$2n = 3$$

$$n = 1\frac{1}{2} \text{ years}$$

Therefore, the time taken is $1\frac{1}{2}$ years.

8. Calculate the C.I. on ₹3,500 at 6% per annum for 3 years, the interest being compounded half-yearly.

Do not use mathematical tables. Use the necessary information from the following:

$$(1.06)^3 = 1.191016; (1.03)^3 = 1.092727$$

$$(1.06)^6 = 1.418519; (1.03)^6 = 1.194052$$

Solution:

Given: $P = ₹3,500$; $r = 6\%$ and $n = 3$ years

As the interest is being compounded half-yearly,

Then,

$$C.I. = P\left[1 + \frac{r}{(2 \times 100)}\right]^{nx2} - 1$$

$$= 3500 \left\{\left[1 + \frac{6}{(2 \times 100)}\right]^{3 \times 2} - 1\right\}$$

$$= 3500 \left[(103/100)^6 - 1\right]$$

$$= 3500 \left[(1.03)^6 - 1\right]$$

$$= 3500 (1.194052 - 1)$$

$$= 3500 \times 0.194052$$

$$= 679.18$$

Therefore,

The C.I. is ₹679.18

9. Find the difference between compound interest and simple interest on ₹12,000 and in $1\frac{1}{2}$ years at 10% compounded yearly.

Solution:

Given: $P = ₹12,000$; $n = 1\frac{1}{2}$ years and $r = 10\%$

So,

$$S.I. = (P \times R \times T)/100$$

$$\begin{aligned} &= (12000 \times 10 \times 3/2)/100 \\ &= 1800 \end{aligned}$$

Hence, the S.I. is ₹1,800

Now, calculating C.I.

For 1 year

P = ₹12,000; n = 1 year and r = 10%

Then,

$$\begin{aligned} A &= P(1 + r/100)^n \\ &= 12000(1 + 10/100)^1 \\ &= 13200 \end{aligned}$$

And, for next 1/2 year

P = ₹13,200; n = 1/2 year and r = 10%

Then,

$$\begin{aligned} A &= P[1 + r(2 \times 100)]^{n \times 2} \\ &= 13200 [1 + 10/(2 \times 100)]^{1/2 \times 2} \\ &= 13860 \end{aligned}$$

Hence, the C.I. = ₹13,860 - ₹12,000 = ₹1,860

So, Difference between C.I. and S.I = ₹1,860 - ₹1,800
= ₹60

10. Find the difference between compound interest and simple interest on ₹12,000 and in 1½ years at 10% compounded half-yearly.

Solution:

Given: P = ₹12,000; n = 1½ years and r = 10%

Then,

$$\begin{aligned} \text{S.I.} &= (P \times R \times T)/100 \\ &= (12000 \times 10 \times 3/2)/100 \\ &= 1800 \end{aligned}$$

Next,

Calculating C.I.(compounded half-yearly)

$$\begin{aligned} A &= P[1 + r/(2 \times 100)]^{n \times 2} \\ &= 12000[1 + 10/(2 \times 100)]^{3/2 \times 2} \\ &= 12000(21/20)^3 \\ &= 13891.50 \end{aligned}$$

So, the C.I. = ₹13,891.50 - ₹12,000 = ₹1891.50

Hence, the difference between C.I. and S.I = ₹1,891.50 - ₹1,800
= ₹91.50

Exercise 3(D)

1. The cost of a machine is supposed to depreciate each year at 12% of its value at the beginning of the year. If the machine is valued at ₹44,000 at the beginning of 2008, find its value:

(i) at the end of 2009.

(ii) at the beginning of 2007.

Solution:

Given:

Cost of machine in 2008 (P) = ₹44,000 and its depreciation rate = 12%

Then,

(i) The cost of machine at the end of 2009 will be

$$\begin{aligned} &= P(1 - r/100)^n \\ &= 44000 (1 - 12/100)^2 \\ &= 44000 (88/100)^2 \\ &= 34073.60 \end{aligned}$$

Hence, the cost of the machine at the end of 2009 is ₹34,073.60

(ii) The cost of machine at the beginning of 2007(P)

$$\begin{aligned} A &= P(1 - r/100)^n \\ 44000 &= P(1 - 12/100)^1 \\ 44000 &= P(88/100) \\ P &= (44000 \times 100)/88 \\ &= 50000 \end{aligned}$$

Hence, the cost of the machine at the beginning of 2007 is ₹50,000

2. The value of an article decreases for two years at the rate of 10% per year and then in the third year it increases by 10%. Find the original value of the article, if its value at the end of 3 years is ₹40,095.

Solution:

Let's assume x to be the value of the article

Given, the value of an article decreases for two years at the rate of 10% per year.

So,

The value of the article at the end of the 1st year will be

$$x - 10\% \text{ of } x = x - 0.10x = 0.90x$$

And,

The value of the article at the end of the 2nd year will be

$$0.90x - 10\% \text{ of } (0.90x) = 0.90x - 0.09x = 0.81x$$

Now,

The value of the article increases in the 3rd year by 10%.

So, the value of the article at the end of 3rd year will be

$$0.81x + 10\% \text{ of } (0.81x) = 0.81x + 0.081 = 0.891x$$

Given that, the value of the article at the end of 3 years is ₹40,095

Then,

$$\begin{aligned}0.891x &= 40095 \\x &= 40095/0.891 \\&= 45000\end{aligned}$$

Therefore,
The original value of the article is ₹45,000.

3, According to a census taken towards the end of the year 2009, the population of a rural town was found to be 64,000. The census authority also found that the population of this particular town had a growth of 5% per annum. In how many years after 2009 did the population of this town reach 74,088?

Solution:

Given: Population in 2009 (P) = 64,000

Let's assume that after 'n' years its population to be 74,088 (A)

Also, given

Growth rate = 5% per annum

We know that,

$$A = P(1 + r/100)^n$$

$$74088 = 64000(1 + 5/100)^n$$

$$74088/64000 = (21/20)^n$$

$$9261/8000 = (21/20)^n$$

$$(21/20)^3 = (21/20)^n$$

On comparing, we get

$$n = 3 \text{ years}$$

Therefore, it took 3 years after 2009 for the population of the town to reach 74,088

4. The population of a town decreased by 12% during 1998 and then increased by 8% during 1999. Find the population of the town, at the beginning of 1998, if at the end of 1999 its population was 2,85,120.

Solution:

Let's assume the population in the beginning of 1998 be P

Given, the population at the end of 1999 = 2,85,120 (A)

According to the question,

$$r_1 = -12\% \text{ and } r_2 = +8\%$$

Then,

$$A = P(1 - r_1/100)(1 + r_2/100)$$

$$285120 = P(1 - 12/100)(1 + 8/100)$$

$$285120 = P(22/25)(27/25)$$

$$P = (285120 \times 25 \times 25)/(22 \times 27)$$

$$= 300000$$

Therefore, the population of the town at the beginning of 1998 was 3,00,000

5. A sum of money, invested at compound interest, amounts to ₹16,500 in 1 year and to ₹19,965 in 3 years. Find the rate per cent and the original sum of money invested.

Solution:

Let's assume the sum of money to be P and the rate of interest = r%

Given, the amount after 1 year = ₹16,500

And, the amount after 3 years = ₹19,965

For 1 year

$$A = P(1 + r/100)^n$$

$$16500 = P(1 + r/100)^1 \dots (1)$$

For 3 years

$$A = P(1 + r/100)^n$$

$$19965 = P(1 + r/100)^3 \dots (2)$$

On dividing equations (2) by (1), we have

$$\frac{19,965}{16,500} = \frac{P\left(1 + \frac{r}{100}\right)^3}{P\left(1 + \frac{r}{100}\right)^1}$$

$$121/100 = (1 + r/100)^2$$

$$(11/10)^2 = (1 + r/100)^2$$

On comparing, we have

$$11/10 = 1 + r/100$$

$$11/10 \times 100 = 100 + r$$

$$110 = 100 + r$$

$$r = 10\%$$

Putting the value of r in equation (1), we get

$$16500 = P(1 + 10/100)$$

$$P = (16500 \times 10)/11$$

$$= 15000$$

Therefore, the rate of interest and original sum of invested are 10% and ₹15,000

6. The difference between C.I. and S.I. on ₹7,500 for two years is ₹12 at the same rate of interest per annum. Find the rate of interest.

Solution:

Given: P = ₹7,500 and time (n) = 2 years

Let's assume the rate of interest as y%

Now,

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

$$= (7500 \times y \times 2)/100$$

$$= 150y$$

And,

$$\begin{aligned} \text{C.I.} &= P(1 + r/100)^n - P \\ &= 7500(1 + y/100)^2 - 7500 \end{aligned}$$

It's given that, C.I. - S.I. = ₹12

$$\begin{aligned} 7500(1 + y/100)^2 - 7500 - 150y &= 12 \\ 7500(1 + y^2/10000 + 2y/100) - 7500 - 150y &= 12 \\ 7500 + 75y^2/100 + 150y - 7500 - 150y &= 12 \\ 75y^2/100 &= 12 \\ 3y^2/4 &= 12 \\ y^2 &= (12 \times 4)/3 = 16 \\ y &= 4\% \end{aligned}$$

Hence, the rate of interest is 4%

7. A sum of money lent out at C.I. at a certain rate per annum becomes three times of itself in 10 years. Find in how many years will the money become twenty-seven times of itself at the same rate of interest p.a.

Solution:

Let's assume the principal to be ₹y and rate = r%

From the question, according to 1st condition

Amount in 10 years = ₹3y

We know that,

$$\begin{aligned} A &= P(1 + r/100)^n \\ 3y &= y(1 + r/100)^{10} \\ 3 &= (1 + r/100)^{10} \dots (1) \end{aligned}$$

According to 2nd condition

Let's consider that after n years amount will be ₹27y

$$\begin{aligned} A &= P(1 + r/100)^n \\ 27y &= y(1 + r/100)^n \\ 3^3 &= (1 + r/100)^n \end{aligned}$$

Using (1), we have

$$\begin{aligned} [(1 + r/100)^{10}]^3 &= (1 + r/100)^n \\ (1 + r/100)^{30} &= (1 + r/100)^n \end{aligned}$$

On comparing,

$$n = 30$$

Hence, it will 30 years for the money to become 27 times of itself.

8. Mr. Sharma borrowed a certain sum of money at 10% per annum compounded annually. If by paying ₹19,360 at the end of the second year and ₹31,944 at the end of the third year he clears the debt; find the sum borrowed by him.

Solution:

Let's assume the sum which Sharma borrowed as P

Given that the rate of interest is 10% and compounded annually

Now, according to the question

At the end of the two years the amount will

$$\begin{aligned}A_1 &= P(1 + r/100)^n \\ &= P(1 + 10/100)^2 \\ &= P(11/10)^2\end{aligned}$$

And,

Mr. Sharma paid ₹19,360 at the end of the second year.

So, for the third year the principal will be $(A_1 - ₹19,360)$

Also given, he cleared the debt by paying ₹31,944 at the end of the third year.

Now,

$$\begin{aligned}A_2 &= P(1 + r/100)^n \\ 31944 &= P[(1 + 10/100)^2 - 19360] (1 + 10/100)^1 \\ 29040 &= P[(11/10)^2 - 19360] \\ P(11/10)^2 &= 48400 \\ P &= 48400 \times (10/11)^2 \\ &= 40000\end{aligned}$$

Therefore, Mr. Sharma borrowed ₹40,000.

9. The difference between compound interest for a year payable half-yearly and simple interest on a certain sum of money lent out at 10% for a year is ₹15. Find the sum of money lent out.

Solution:

Let's assume the sum of money to be ₹y

Calculating the S.I.

$$\begin{aligned}\text{S.I.} &= (P \times R \times T)/100 \\ &= (y \times 10 \times 1)/100 \\ &= y/10\end{aligned}$$

And,

Calculating C.I.(compounded half-yearly)

$$\begin{aligned}\text{C.I.} &= P \{ [1 + r/(2 \times 100)]^{n \times 2} - 1 \} \\ &= y \{ [1 + 10/(2 \times 100)]^{1 \times 2} - 1 \} \\ &= y[(21/20)^2 - 1] \\ &= (41/400)y\end{aligned}$$

It's given that C.I. – S.I. = ₹15

So,

$$(41/400)y - y/10 = 15$$

$$y/400 = 15$$

$$y = 6000$$

Therefore, the sum of money lent out is ₹6,000

10. The ages of Pramod and Rohit are 16 years and 18 years respectively. In what ratio must they invest money at 5% p.a. compounded yearly so that both get the same sum on attaining the age of 25 years?

Solution:

Let's assume that ₹x and ₹y to be the money invested by Pramod and Rohit respectively such that they will get the same sum on attaining the age of 25 years.

Now,

Pramod will attain the age of 25 years after $(25 - 16) = 9$ years

Rohit will attain the age of 25 years after $(25 - 18) = 7$ years

So, we have

$$x(1 + 5/100)^9 = y(1 + 5/100)^7$$

$$x/y = 1/(1 + 5/100)^2$$

$$x/y = 400/441$$

Therefore,

Pramod and Rohit should invest in the ratio 400:441 respectively such that they will get the same sum on attaining the age of 25.

Exercise 3(E)

1. Simple interest on a sum of money for 2 years at 4% is ₹450. Find compound interest on the same sum and at the same rate for 1 year, if the interest is reckoned half yearly.

Solution:

Given: S.I. = ₹450; N = 2 years and rate(R) = 4%

Let's consider the principal to be P

Now, we have

$$\begin{aligned} P &= (S.I \times 100)/(R \times T) \\ &= (450 \times 100)/(4 \times 2) \\ &= 5625 \end{aligned}$$

Thus, the principal is ₹5625

Now,

When the interest is compounded half-yearly

P = ₹5,625; n = 1 year and r = 4%

$$\begin{aligned} A &= P[1 + r/(2 \times 100)]^{n \times 2} \\ &= 5625(1 + 4/200)^{1 \times 2} \\ &= 5625(51/50)^2 \\ &= 5852.25 \end{aligned}$$

Hence,

$$\begin{aligned} C.I. &= ₹5852.25 - ₹5,625 \\ &= ₹227.25 \end{aligned}$$

2. Find the compound interest to the nearest rupee on ₹10,800 for 2½ years at 10% per annum.

Solution:

Given: P = ₹10,800; Time (N) = 2½ years and rate = 10% p.a

For 2 years,

We know that,

$$\begin{aligned} A &= P(1 + r/100)^n \\ &= 10800(1 + 10/100)^2 \\ &= 13068 \end{aligned}$$

And,

For ½ year

$$\begin{aligned} A &= P[1 + r/(2 \times 100)]^{n \times 2} \\ &= 13,068(1 + 10/200)^{1/2 \times 2} \\ &= 13068 \times 21/20 \\ &= 13721.40 \\ &\sim 13721 \text{ (nearest rupee)} \end{aligned}$$

Hence,

$$C.I. = A - P = ₹(13,721 - 10,800) = ₹2,921$$

3. The value of a machine, purchased two years ago, depreciates at the annual rate of

10%. If its present value is ₹97,200, find:

i. Its value after 2 years.

ii. Its value when it was purchased.

Solution:

Given,

Present value of machine(P) = ₹97,200

Depreciation rate = 10%

$$\begin{aligned}\text{(i) Value of machine after 2 years} &= P(1 - r/100)^n \\ &= 97200 (1 - 10/100)^2 \\ &= 97200 \times (9/10)^2 \\ &= 78732\end{aligned}$$

Thus, the value of the machine after 2 years is ₹78,732

(ii) Now,

To calculate the cost 2 years ago

We know that,

$$A = P(1 - r/100)^n$$

$$97200 = P(1 - 10/100)^2$$

$$97200 = P(9/10)^2$$

$$\begin{aligned}P &= 97200 \times (10/9)^2 \\ &= 1,20,000\end{aligned}$$

Thus, the value of the machine when it was purchased was ₹1,20,000

4. Anuj and Rajesh each lent the same sum of money for 2 years at 8% simple interest and compound interest respectively. Rajesh received ₹64 more than Anuj. Find the money lent by each and interest received.

Solution:

Let's assume the sum of money lent by both as ₹y

Then,

For Anuj

P = ₹y; rate = 8% and time = 2 years

So,

$$\begin{aligned}\text{S.I.} &= (P \times R \times T)/100 \\ &= (y \times 8 \times 2)/100 \\ &= 4y/25\end{aligned}$$

For Rajesh

P = ₹y; rate = 8% and time = 2 years

$$\begin{aligned}\text{C.I.} &= P \left[\left\{ 1 + r/(100) \right\}^n - 1 \right] \\ &= y \left[\left\{ 1 + 8/(100) \right\}^2 - 1 \right] \\ &= 104y/625\end{aligned}$$

Now,

It's given that, difference in the interests i.e. C.I. - S.I. = ₹64

So,

$$104y/625 - 4y/25 = 64$$

$$(104y - 100y)/625 = 64$$

$$4y/625 = 64$$

$$y = (64 \times 625)/4$$

$$= 10,000$$

Therefore,

$$\text{The interest received by Anuj} = (4 \times ₹10,000)/25 = ₹1600$$

$$\text{The interest received by Rajesh} = (104 \times ₹10,000)/625 = ₹1664$$

5. Calculate the sum of money on which the compound interest (payable annually) for 2 years be four times the simple interest on ₹4,715 for 5 years, both at the rate of 5% per annum.

Solution:

Given: Principal = ₹4,715; time = 5 years and rate = 5% p.a.

Let's assume the sum of money as P

So,

$$\text{S.I.} = (P \times R \times T)/100$$

$$= (4715 \times 5 \times 5)/100$$

$$= ₹1178.75$$

Then, C.I. = ₹1,178.75 x 4 = ₹4,715 (according to question)

We have, time = 2 years and rate = 5%

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

$$4715 = P[(1 + 5/100)^2 - 1]$$

$$4715 = P(41/400)$$

$$P = (4715 \times 400)/41$$

$$= 46000$$

Therefore, the sum of money is ₹46,000

6. A sum of money was invested for 3 years, interest being compounded annually. The rates for successive years were 10%, 15% and 18% respectively. If the compound interest for the second year amounted to ₹4,950, find the sum invested.

Solution:

Given: C.I. for the 2nd year = ₹4,950 and rate = 15%

Then,

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

$$4950 = P [(1 + 15/100)^2 - 1]$$

$$4950 = P(3/20)$$

$$P = (4950 \times 20)/3$$

$$= 33000$$

Then, the amount at the end of 2nd year is ₹33,000

So, for the first 2 years

$$A = \text{Rs.}33,000; r_1 = 10\%$$

$$A = P(1 + r_1/100)$$

$$33000 = P(1 + 10/100)$$

$$33000 = P(1 + 11/10)$$

$$P = (33000 \times 10)/11 \\ = 30,000$$

Thus, the sum invested is ₹30,000.

7. A sum of money is invested at 10% per annum compounded half yearly. If the difference of amounts at the end of 6 months and 12 months is ₹189, find the sum of money invested.

Solution:

Let's assume the sum of money to be ₹y

And, given rate = 10% p.a. compounded half yearly

Now, for first 6 months

$$A = P[1 + r/(2 \times 100)]^{n \times 2} \\ = y[1 + 10/(2 \times 100)]^{1/2 \times 2} \\ = y(1 + 10/200)^1 \\ = (21/20)y$$

And,

For first 12 months

$$A = P[1 + r/(2 \times 100)]^{n \times 2} \\ = y[1 + 10/(2 \times 100)]^{1 \times 2} \\ = y(1 + 10/200)^2 \\ = (441/400)y$$

Also given, the difference between the above amounts = ₹189

So,

$$(441/400)y - (21/20)y = 189$$

$$(21/400)y = 189$$

$$y = (189 \times 400)/21$$

$$y = 3600$$

Thus, the sum of money invested is ₹3,600

8. Rohit borrows ₹86,000 from Arun for two years at 5% per annum simple interest. He immediately lends out this money to Akshay at 5% compound interest compounded annually for the same period. Calculate Rohit's profit in the transaction at the end of two years.

Solution:

Given: $P = ₹86,000$; time = 2 years and rate = 5% p.a.

Calculating S.I.

$$\begin{aligned} \text{S.I.} &= (P \times R \times T)/100 \\ &= (86000 \times 5 \times 2)/100 \\ &= 8600 \end{aligned}$$

Calculating C.I.

$$\begin{aligned} \text{C.I.} &= P [(1 + r/100)^n - 1] \\ &= 86000 [(1 + 5/100)^2 - 1] \\ &= 86000 (41/40) \\ &= 8815 \end{aligned}$$

Thus, the profit = C.I. - S.I. = ₹(8,815 - 8,600) = ₹215

9. The simple interest on a certain sum of money for 3 years at 5% per annum is ₹1,200. Find the amount and the compound interest due on this sum of money at the same rate and after 2 years. Interest is reckoned annually.

Solution:

Let's assume ₹P to be the sum of money

Rate = 5% p.a., S.I. = ₹1,200 and $n = 3$ years.

Then,

$$\begin{aligned} 1200 &= (P \times 5 \times 3)/100 \\ x &= 1200/15 \\ &= 8000 \end{aligned}$$

So,

The amount due and the compound interest on this sum of money at the same rate and after 2 years

$P = ₹8,000$; rate = 5% p.a. and $n = 3$ years

We know that,

$$\begin{aligned} A &= P (1 + r/100)^n \\ &= 8000 (1 + 5/100)^2 \\ &= 8000 (1.1025) \\ &= 8820 \end{aligned}$$

Hence, C.I. = $A - P = ₹(8,820 - 8,000) = ₹820$

The amount due after 2 years is ₹8,820 and the compound interest is ₹820

10. Nikita invests ₹6,000 for two years at a certain rate of interest compounded annually. At the end of first year it amounts to ₹6,720. Calculate:

(a) The rate of interest.

(b) The amount at the end of the second year.

Solution:

Let's assume $x\%$ to be the rate of interest

$P = ₹6000$, $n = 2$ year and $A = ₹6720$

For the first year

$$A = P (1 + r/100)^n$$

$$6720 = 6000 (1 + x/100)^1$$

$$6720 = 6000 + 10x$$

$$6720 - 6000 = 60x$$

$$x = 720/10$$

$$= 12$$

Hence,

The rate of interest is 12%.

So,

The amount at the end of the second year will be

$$A = 6000 (1 + 12/100)^2$$

$$= 6000 (112/100)^2$$

$$= 7526.40$$

Therefore,

The amount at the end of the second year is ₹7,526.40