Chapter 3. Compound Interest (Using Formula)

Exercise 3(A)

Solution 1:

Given : P= Rs12,000; n=3years and r=5%

$$\text{Amount} = P\left(1+\frac{r}{100}\right)^n = 12000\left(1+\frac{5}{100}\right)^3$$

$$= 12000\left(\frac{21}{20}\right)^3$$

=Rs13,891.50 Ans.

∴ C.I. =RS13,891.50 - Rs12,000

= Rs1,891.50 Ans.

Solution 2:

Given : P= Rs15,000; n=2years; r_1 =8% and r_2 =10%

$$\text{Amount} = P\left(1+\frac{r_1}{100}\right)\left(1+\frac{r_2}{100}\right) = 15,000\left(1+\frac{8}{100}\right)\left(1+\frac{10}{100}\right)$$

$$= 15,000\left(\frac{27}{25}\right)\left(\frac{11}{10}\right)$$

=Rs17,820 Ans.

Solution 3:

Given : P=Rs6,000; n= 3years; r_1= 5%; r_2= 8% and r_3 =10%

$$\text{Amount} = P\left(1+\frac{r_1}{100}\right)\left(1+\frac{r_2}{100}\right)\left(1+\frac{r_3}{100}\right)$$

$$= 6,000\left(1+\frac{5}{100}\right)\left(1+\frac{8}{100}\right)\left(1+\frac{10}{100}\right)$$

$$= 6000\left(\frac{21}{20}\right)\left(\frac{27}{25}\right)\left(\frac{11}{10}\right)$$

=Rs7,484.40

∴ C.I. = Rs7,484.40 - Rs6,000 = Rs1,484.40 Ans.

Solution 4:

Given : Amount= Rs5,445; n= 2years and r = 10%

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

$\Rightarrow 5{,}445 = P\left(1+\frac{10}{100}\right)^2$

$\Rightarrow 5{,}445 = P\left(\frac{11}{10}\right)^2$

$\Rightarrow P = 5{,}445\left(\frac{10}{11}\right)^2 = \text{Rs}4{,}500$ Ans.

Solution 5:

Given : C.I.= Rs768.75; n= 2years and r = 5%

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

$\Rightarrow A = P\left(1+\frac{5}{100}\right)^2$

$\Rightarrow A = P\left(\frac{21}{20}\right)^2 = \frac{441}{400}P$

$\therefore\ A - P = C.I$

$\Rightarrow \frac{441}{400}P - P = \text{Rs}768.75$

$\Rightarrow \frac{41}{400}P = \text{Rs}768.75$

$\Rightarrow P = \text{Rs}\frac{768.75 \times 400}{41} = \text{Rs}7{,}500$ Ans.

Solution 6:

Given : C.I.= Rs1,655; n= 3years and r = 10%

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

$\Rightarrow A = P\left(1+\frac{10}{100}\right)^3$

$\Rightarrow A = P\left(\frac{11}{10}\right)^3 = \frac{1,331}{1,000}P$

$\therefore A - P = C.I$

$\Rightarrow \frac{1,331}{1,000}P - P = Rs1,655$

$\Rightarrow \frac{331}{1,000}P = Rs1,655$

$\Rightarrow P = Rs\ \frac{1,655 \times 1,000}{331} = Rs5,000$ Ans.

Solution 7:

Given : Amount =Rs9,856; n=2years; r_1 =10% and r_2 =12%

$\therefore Amount = P\left(1+\frac{r_1}{100}\right)\left(1+\frac{r_2}{100}\right)$

$\Rightarrow 9,856 = P\left(1+\frac{10}{100}\right)\left(1+\frac{12}{100}\right)$

$\Rightarrow 9,856 = P\left(\frac{11}{10}\right)\left(\frac{28}{25}\right)$

$\Rightarrow P = Rs\ \frac{9,856 \times 10 \times 25}{11 \times 28} = Rs8,000$

Ans.

Solution 8:

$A = P\left(1+\frac{r_1}{100}\right)\left(1+\frac{r_2}{100}\right)$

$\Rightarrow (P + 4240) = P\left(1+\frac{10}{100}\right)\left(1+\frac{15}{100}\right)$

$\Rightarrow (P + 4240) = P\,(1.265)$

$\Rightarrow P = 16000$

The sum is ₹16,000

Solution 9:

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

$$\Rightarrow 6,615 = 6,000\left(1+\frac{r}{100}\right)^2$$

$$\Rightarrow \left(1+\frac{r}{100}\right)^2 = \frac{6,615}{6,000}$$

$$\Rightarrow 1+\frac{r}{100} = \frac{21}{20}$$

$$\Rightarrow r = 5\%$$

At 5% per annum the sum of Rs.6,000 amounts to Rs.6,615 in 2 years when the interest is compounded annually.

Solution 10:

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

Let Principal = Rs y
Then Amount= Rs 1.44y
n= 2years

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

$$\Rightarrow 1.44y = y\left(1+\frac{r}{100}\right)^2$$

$$\Rightarrow \frac{1.44y}{y} = \left(1+\frac{r}{100}\right)^2$$

$$\Rightarrow \frac{36}{25} = \left(1+\frac{r}{100}\right)^2$$

$$\Rightarrow \left(\frac{6}{5}\right)^2 = \left(1+\frac{r}{100}\right)^2$$

On comparing,

$$\frac{6}{5} = 1+\frac{r}{100}$$

On solving, we get

$$r = 20\%$$

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

Solution 11:

Given: P = Rs. 4, 000, C.I. = Rs. 1, 324 and n = 3 years

Now, A = P + I

$\Rightarrow$ A = Rs. (4, 000 + 1, 324) = Rs. 5, 324

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

$$\Rightarrow 5324 = 4000\left(1+\frac{r}{100}\right)^3$$

$$\Rightarrow \frac{5324}{4000} = \left(1+\frac{r}{100}\right)^3$$

$$\Rightarrow \frac{1331}{1000} = \left(1+\frac{r}{100}\right)^3$$

$$\Rightarrow \left(1+\frac{R}{100}\right)^3 = \frac{1331}{1000} = \left(\frac{11}{10}\right)^3$$

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

$$\Rightarrow \frac{r}{100} = \frac{11}{10} - 1 = \frac{1}{10}$$

$$\Rightarrow r = \frac{100}{100} = 10\%$$

Thus, the rate of interest is 10%.

Solution 12:

Given: P=Rs5,000; A=Rs6,272 and n= 2years

(i)

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

$$\Rightarrow 6,272 = 5,000\left(1+\frac{r}{100}\right)^2$$

$$\Rightarrow \frac{6,272}{5,000} = \left(1+\frac{r}{100}\right)^2$$

$$\Rightarrow \frac{784}{625} = \left(1+\frac{r}{100}\right)^2$$

$$\Rightarrow \left(\frac{28}{25}\right)^2 = \left(1+\frac{r}{100}\right)^2$$

On comparing

$$\frac{28}{25} = 1+\frac{r}{100}$$

On solving, we get

r =12%

(ii) Amount at the third year

$$= 5,000\left(1+\frac{12}{100}\right)^3$$

$$= 5,000\left(\frac{28}{25}\right)^3$$

= Rs7,024.64

Solution 13:

Given : P=Rs7,000; A=Rs9,317 and r= 10%

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

$$\Rightarrow 9,317=7,000\left(1+\frac{10}{100}\right)^n$$

$$\Rightarrow \frac{9,317}{7,000}=\left(\frac{11}{10}\right)^n$$

$$\Rightarrow \frac{1,331}{1,000}=\left(\frac{11}{10}\right)^n$$

$$\Rightarrow \left(\frac{11}{10}\right)^3=\left(\frac{11}{10}\right)^n$$

On comparing

n = 3years

Solution 14:

Given : P=Rs4,000; C.I.=Rs630.50 and r=5%

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

$$\Rightarrow 630.50=4,000\left[\left(1+\frac{5}{100}\right)^n-1\right]$$

$$\Rightarrow \frac{630.50}{4,000}=\left[\left(\frac{21}{20}\right)^n-1\right]$$

$$\Rightarrow \frac{1,261}{8,000}=\left(\frac{21}{20}\right)^n-1$$

$$\Rightarrow \frac{1,261}{8,000}+1=\left(\frac{21}{20}\right)^n$$

$$\Rightarrow \frac{9,261}{8,000}=\left(\frac{21}{20}\right)^n$$

$$\Rightarrow \left(\frac{21}{20}\right)^3=\left(\frac{21}{20}\right)^n$$

On comparing

n = 3years

Solution 15:

Let share of A = Rs y
share of B = Rs (28,730 - y)
rate of interest= 10%
According to question
Amount of A in 3years= Amount of B in 5years

$$\Rightarrow y\left(1+\frac{10}{100}\right)^3 = (28,730-y)\left(1+\frac{10}{100}\right)^5$$

$$\Rightarrow y = (28,730-y)\left(1+\frac{10}{100}\right)^2$$

$$\Rightarrow y=(28,730-y)\left(\frac{121}{100}\right)$$

$$\Rightarrow 100y=121(28,730-y)$$

$$\Rightarrow 100y+121y=121\times 28,730$$

$$\Rightarrow 221y=121\times 28,730$$

$$\Rightarrow y=\frac{121\times 28,730}{221} = Rs15,730$$

Therefore share of A=Rs15,730
Share of B=Rs28,730 - Rs 15,730=Rs13,000

Solution 16:

(i)Let share of John = Rs y
share of Smith = Rs (44,200 - y)
rate of interest= 10%
According to question
Amount of John in 4years= Amount of Smith in 2years

$$\Rightarrow y\left(1+\frac{10}{100}\right)^4 = (44,200-y)\left(1+\frac{10}{100}\right)^2$$

$$\Rightarrow y\left(1+\frac{10}{100}\right)^2 = (44,200-y)$$

$$\Rightarrow y\left(\frac{11}{10}\right)^2 =(44,200-y)$$

$$\Rightarrow 121y=100(44,200-y)$$

$$\Rightarrow 121y=100\times 44,200 - 100y$$

$$\Rightarrow 121y+100y=100\times 44,200$$

$$\Rightarrow 221y=100\times 44,200$$

$$\Rightarrow y=\frac{100\times 44,200}{221} = Rs20,000$$

Therefore share of John=Rs20,000
Share of Smith=Rs44,200- Rs 20,000=Rs24,200
(ii)Amount that each will receive

$$= 20,000\left(1+\frac{10}{100}\right)^4$$

$$= 20,000\left(\frac{11}{10}\right)^4$$

$$= Rs29,282$$

Solution 17:

(i) I = Rs. 6000, T = 2 years and R = 10%

$$\therefore P = \frac{I \times 100}{R \times T} = \frac{6000 \times 100}{10 \times 2} = \text{Rs. } 30,000$$

(ii) P = Rs. 30,000, n = 3 years and r = 10%

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

$$= 30000\left(1 + \frac{10}{100}\right)^3$$

$$= 30000\left(\frac{11}{10}\right)^3$$

$$= 30000 \times \frac{11}{10} \times \frac{11}{10} \times \frac{11}{10}$$

$$= \text{Rs. } 39,930$$

(iii) C.I. earned in 3 years = A – P = Rs. (39,930 – 30,000) = Rs. 930

Solution 18:

Given: P = Rs. 8000, R = 5%, T = 2 years

For simple interest,

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

$$= \frac{8,000 \times 5 \times 2}{100}$$

$$= \text{Rs. } 800$$

For compound interest,

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

$$A = 8,000\left(1 + \frac{5}{100}\right)^2$$

$$= 8,000 \times \frac{21}{20} \times \frac{21}{20}$$

$$= \text{Rs. } 8,820$$

C.I. = A – P

= Rs. (8,820 – 8,000)

= Rs. 820

Now, C.I. – S.I. = Rs. (820 – 800) = Rs. 20

Thus, the difference between the compound interest and the simple interest is Rs. 20.

Exercise 3(B)

Solution 1:

Let principal (P) = x
R = 8%
T = 2 years

$$SI = \frac{x \times 8 \times 2}{100} = \frac{4x}{25}$$

$$CI = A - P = x\left(1 + \frac{8}{100}\right)^2 - x$$

$$= x\left[\left(1 + \frac{2}{25}\right)^2 - 1\right]$$

$$= x\left[\left(\frac{27}{25}\right)^2 - 1\right]$$

$$= \frac{104}{625}x$$

Given, CI = SI = 54.40

$$\frac{104x}{625} - \frac{4x}{25} = Rs.54.40$$

$$x\left(\frac{104}{625} - \frac{4}{25} \times \frac{25}{25}\right) = 54.40$$

$$x\left(\frac{4}{625}\right) = 54.40$$

$$x = \frac{54.40 \times 625}{4}$$

$$x = Rs.8500$$

Thus, principalsum = Rs. 8500

Solution 2:

(for 2 years) A = Rs. 19360
T = 2 years
Let P = X

$$\times\left(1+\frac{R}{100}\right)^2 = 19360 \ldots(1)$$

A (for 4 years) = Rs. 23425.60

$$\times\left(1+\frac{R}{100}\right)^4 = 23425.60 \ldots(2)$$

(2) $\div$ (1)

$$\left(1+\frac{R}{100}\right)^2 = \frac{23425.60}{19360}$$

$$\left(1+\frac{R}{100}\right)^2 = \frac{2342560}{1936000}$$

$$\left(1+\frac{R}{100}\right)^2 = \frac{14641}{12100}$$

$$\left(1+\frac{R}{100}\right)^2 = \left(\frac{121}{110}\right)^2$$

$$1+\frac{R}{100} = \frac{121}{110}$$

$$\frac{R}{100} = \frac{121}{110} - 1$$

$$R = 10\%$$

Form (1) $\times\left(1+\frac{10}{100}\right)^2 = 19360$

$$\times = \frac{19360 \times 10 \times 10}{11 \times 11}$$

$$\times = \text{Rs. } 16000$$

Thus, sum = Rs. 16000

Solution 3:

Let principal = x, A = 3x, T = 8 years, R = ?
Case I,

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

$$3x = x\left(1+\frac{R}{100}\right)^{8}$$

$$3^{y/8} = 1+\frac{R}{100} \qquad \ldots(1)$$

Case II,
P = x,A = 27x,T = ?

$$27x = x\left(1+\frac{R}{100}\right)^{T}$$

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

From (1) and (2) $3^{1/8} = 27^{1/T}$

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

$$T = 24$$

Time = 24 years.

Solution 4:

P = Rs. 9430
R = 5%
R = 10 years

$$SI = \frac{9430 \times 5 \times 10}{100} = Rs.4715$$

Let sum = x
CI = 4715, T = 2 years, Rs= 5%
CI = AP

$$4715 = x\left(1+\frac{R}{100}\right)^{T} - x$$

$$4715 = x\left(1+\frac{5}{100}\right)^{2} - x$$

$$4715 = x\left[\left(\frac{21}{20}\right)^{2} - 1\right]$$

$$4715 = x\left(\frac{441-400}{400}\right)$$

$$x = \frac{4715 \times 400}{41} = Rs.46,000$$

Thus principal from = Rs. 46,000

Solution 5:

Let principal = Rs. 100, R = 5% T = 2 years

For Kamal, SI = $\frac{100 \times 5 \times 2}{100} = Rs.10$

For Anand, $A = P\left(1+\frac{R}{100}\right)^T$

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

$= 100 \times \frac{21}{20} \times \frac{21}{20}$

$= \frac{441}{4}$

CI = $\frac{441}{4} - 100 = \frac{41}{4}$

Difference of CI and SI = $\frac{41}{4} - 10$

$= \frac{41-40}{4}$

$= Rs.\frac{1}{4}$

When difference is Rs. $\frac{1}{4}$, then principal = Rs. 100

If difference is 1, principal = 100×4

If difference is Rs, 15, principal = $100 \times 4 \times 15$ = Rs. 6000

Solution 6:

SI = Rs. 450
R = 4%
R = 2 years
P = ?

$$P = \frac{SI \times 100}{R \times T} = \frac{450 \times 100}{4 \times 2} = Rs.5625$$

Now, P = 5625, R = 4%, T = 2 years

$$A = 5625\left(1+\frac{4}{100}\right)^2 = 5625\left(\frac{26}{25}\right)^2$$

$$= \frac{3802500}{625} = Rs.6084$$

Solution 7:

Let principal (P), R = 4%, T = 4 years

$$SI = \frac{P \times 4 \times 4}{100} = \frac{4P}{25}$$

$$CI = P\left(1+\frac{5}{100}\right) - P = P\left[\left(\frac{21}{20}\right)^3 - 1\right] = P\left(\frac{9261}{8000} - 1\right)$$

$$= \frac{1261}{8000}P$$

Given SI -; CI = Rs. 228

$$\frac{4P}{25} - \frac{1261}{8000}P = 228$$

$$\frac{4 \times 320P - 1261P}{8000} = 228$$

$$19P = 228 \times 8000$$

$$P = \frac{228 \times 8000}{19} = Rs.96000$$

Thus, Principal = Rs. 96000

Solution 8:

CI = Rs. 246, R = 5%, T = 2 years
CI = A - P

$$246 = P\left(1+\frac{5}{100}\right)^2 - P$$

$$246 = P\left[\left(\frac{21}{20}\right)^2 - 1\right]$$

$$246 = P\frac{61}{400}$$

$$P = \frac{246 \times 400}{41}$$

$$= Rs.2400$$

Now, P = Rs. 2400 ,R = 6%, T = 3 years

$$SI = \frac{2400 \times 6 \times 3}{100}$$

$$= Rs.432$$

Solution 9:

Let the sum (principle) = x
Given Amount = 23400, R = 10% and T = 3 years

$$\Rightarrow \text{interest I} = \frac{x \times 10 \times 3}{100} = \frac{3x}{10}$$

Amount = Principle + Interest

$$23400 = x + \frac{3x}{10}$$

$x = 18000$

Principle = 18000

Now,

Principle = `18000, r = 10% and n = 2 years

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

$$A = 18000\left(1 + \frac{10}{100}\right)^2$$

$$A = 18000\left(\frac{11}{10}\right)^2$$

$$A = 18000\left(\frac{121}{100}\right)$$

$$A = 21780$$

The amount of the same sum in 2 years and at 10% p.a. compound interest is 21780.

Solution 10:

For the payment of Rs. 12,600 at the end of first year:

A = Rs. 12,600; n = 1 year and r = 5%

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

$\Rightarrow 12,600 = P\left(1+\frac{5}{100}\right)^1$

$\Rightarrow 12,600 = P\left(\frac{21}{20}\right)$

$\Rightarrow P = \frac{20}{21} \times 12,600 = \text{Rs. } 12,000$

For the payment of Rs. 17,640 at the end of second year:

A = Rs. 17,640; n = 2 years and r = 5%

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

$\Rightarrow 17,640 = P\left(1+\frac{5}{100}\right)^2$

$\Rightarrow 17,640 = P\left(\frac{21}{20}\right)^2$

$\Rightarrow P = \frac{20}{21} \times \frac{20}{21} \times 17,640 = \text{Rs. } 16,000$

$\therefore$ Sum borrowed = Rs. (12,000 + 16,000) = Rs. 28,000

Exercise 3(C)

Solution 1:

Given: P=Rs7,400; r=5% p.a. and n= 1year

Since the interest is compounded half-yearly,

Then $A=P\left(1+\frac{r}{2\times 100}\right)^{n\times 2}$

$= 7,400\left(1+\frac{5}{2\times 100}\right)^{1\times 2}$

$= 7,400\left(\frac{41}{40}\right)^2$

= Rs7,774.63

Solution 2:

(i)When interest is compounded yearly

Given: P=Rs10,000; n=18months= $1\frac{1}{2}$ year and r=10%p.a.

For 1year

$$A=P\left(1+\frac{r}{100}\right)^{n}=10,000\left(1+\frac{10}{100}\right)^{1}=10,000\left(\frac{11}{10}\right)^{1}=Rs11,000$$

For1/2 year

P=Rs11,000;n= 1/2 year and r=10%

$$A=P\left(1+\frac{r}{2\times100}\right)^{n\times2}=11,000\left(1+\frac{10}{2\times100}\right)^{\frac{1}{2}\times2}=11,000\left(\frac{21}{20}\right)^{1}$$

$=Rs11,550$

$\therefore$ C.I.= Rs11,550 - Rs10,000= Rs1,550

(ii)When interest is compounded half-yearly

P=Rs10,000; n= $1\frac{1}{2}$ year and r=10%p.a.

$$A=P\left(1+\frac{r}{2\times100}\right)^{n\times2}=10,000\left(1+\frac{10}{2\times100}\right)^{\frac{3}{2}\times2}$$

$$=10,000\left(\frac{21}{20}\right)^{3}$$

$=Rs11,576.25$

$\therefore$ C.I.= Rs11,576.25 - Rs10,000=Rs1,576.25

$\therefore$ Difference between both C.I.= Rs1,576.25 - Rs1,550

= Rs26.25 Ans.

Solution 3:

For the first 2 years

$$\text{S.I.} = \frac{P \times N \times R}{100}$$
$$\Rightarrow \text{S.I.} = \frac{16,000 \times 2 \times 20}{100}$$
$$\Rightarrow \text{S.I.} = 6,400$$

$$\text{Amount} = \text{S.I.} + P$$
$$\Rightarrow \text{Amount} = 6,400 + 16,000$$
$$\Rightarrow \text{Amount} = 22,400$$

Amount in the account at the end of the two years is ₹22,400.

For the remaining one year

$$A = P\left(1 + \frac{r}{2 \times 100}\right)^{n \times 2}$$
$$\Rightarrow A = 22,400\left(1 + \frac{20}{200}\right)^{2}$$
$$\Rightarrow A = 22,400\left(\frac{11}{10}\right)^{2}$$
$$\Rightarrow A = 27,104$$

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

Solution 4:

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

$$\Rightarrow 27,783 = P\left(1+\frac{10}{200}\right)^{\frac{3}{2}\times 2}$$

$$\Rightarrow 27,783 = P\left(\frac{21}{20}\right)^{3}$$

$$\Rightarrow P = 27,783\left(\frac{20}{21}\right)^{3}$$

$$\Rightarrow P = 24,000$$

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

Solution 5:

(i)For Ashok(interest is compounded yearly)

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

For 1year

$$A=P\left(1+\frac{r}{100}\right)^{n} = y\left(1+\frac{20}{100}\right)^{1} = \left(\frac{6}{5}\right)y$$

For1/2 year

P= Rs $\left(\frac{6}{5}\right)$y ;n= ½ year and r=20%

$$A=P\left(1+\frac{r}{2\times 100}\right)^{n\times 2} = Rs\left(\frac{6}{5}\right)y\left(1+\frac{20}{2\times 100}\right)^{\frac{1}{2}\times 2} = Rs\left(\frac{66}{50}\right)y$$

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

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

$$A=P\left(1+\frac{r}{2\times 100}\right)^{n\times 2} = y\left(1+\frac{20}{2\times 100}\right)^{\frac{3}{2}\times 2} = y\left(\frac{11}{10}\right)^{3}$$

$$= Rs\left(\frac{1,331}{1,000}\right)y$$

According to question

$$\therefore \left(\frac{1,331}{1,000}\right)y - \left(\frac{66}{50}\right)y = Rs33$$

$$\Rightarrow \left(\frac{11}{1,000}\right)y = Rs33$$

$$\Rightarrow y = Rs\frac{33\times 1,000}{11} = Rs3,000$$

∴ Money invested by each person=Rs3,000 Ans.

Solution 6:

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

$$\Rightarrow 5,100 = 62,500\left[\left(1+\frac{r}{200}\right)^{2}-1\right]$$

$$\Rightarrow \left(1+\frac{r}{200}\right)^{2} = \frac{67,600}{62,500}$$

$$\Rightarrow 1+\frac{r}{200} = \frac{260}{250}$$

$$\Rightarrow r = 8$$

The rate of interest is 8%.

Solution 7:

Given: P=Rs1,500; C.I.=Rs496.50 and r=20%
Since interest is compounded semi-annually

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

$$\Rightarrow 496.50 = 1,500\left[\left(1+\frac{20}{2\times 100}\right)^{n\times 2}-1\right]$$

$$\Rightarrow \frac{496.50}{1,500} = \left(\frac{11}{10}\right)^{2n}-1$$

$$\Rightarrow \frac{331}{1,000}+1 = \left(\frac{11}{10}\right)^{2n}$$

$$\Rightarrow \frac{1,331}{1,000} = \left(\frac{11}{10}\right)^{2n}$$

$$\Rightarrow \left(\frac{11}{10}\right)^{3} = \left(\frac{11}{10}\right)^{2n}$$

On comparing, we get

$2n=3 \Rightarrow n=1\frac{1}{2}$ years Ans.

Solution 8:

Given: P=Rs 3,500; r=6% and n= 3years
Since interest is being compounded half-yearly

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

$= 3,500\left[\left(1+\frac{6}{2\times 100}\right)^{3\times 2} - 1\right]$

$= 3,500\left[\left(\frac{103}{100}\right)^{6} - 1\right]$

$= 3,500\left[(1.03)^{6} - 1\right]$

$= 3,500[1.194052 - 1]$

$= 3,500 \times 0.194052$

$= Rs679.18$

Ans.

Solution 9:

Given: P=Rs12,000; n= $1\frac{1}{2}$ years and r= 10% $S.I. = \frac{P\times R\times T}{100} = \frac{12,000\times 10\times \frac{3}{2}}{100} = Rs1,800$

To calculate C.I.
For 1year
P=Rs12,000; n=1year and r=10%

$A = P\left(1+\frac{r}{100}\right)^{n} = 12,000\left(1+\frac{10}{100}\right)^{1} = Rs13,200$

For next 1/2 year
P=Rs13,200;n= 1/2 year and r=10%

$A = P\left(1+\frac{r}{2\times 100}\right)^{n\times 2} = 13,200\left(1+\frac{10}{2\times 100}\right)^{\frac{1}{2}\times 2}$

$= 13,200\left(\frac{21}{20}\right)^{1}$

$= Rs13,860$

∴ C.I.=Rs13,860 - Rs12,000= Rs1,860
∴ Difference between C.I. and S.I
=Rs1,860 - Rs1,800=Rs60 Ans.

Solution 10:

Given: P=Rs12,000; n= $1\frac{1}{2}$ years and r= 10% $S.I. = \frac{P \times R \times T}{100} = \frac{12,000 \times 10 \times \frac{3}{2}}{100} = Rs1,800$

To calculate C.I.(compounded half-yearly)

P=Rs12,000;n= $1\frac{1}{2}$ years and r=10%

$$A = P\left(1 + \frac{r}{2 \times 100}\right)^{n \times 2} = 12,000\left(1 + \frac{10}{2 \times 100}\right)^{\frac{3}{2} \times 2}$$

$$= 12,000\left(\frac{21}{20}\right)^3$$

$$= Rs13,891.50$$

∴ C.I.= Rs13,891.50 - Rs12,000= Rs1,891.50

∴ Difference between C.I. and S.I

=Rs1,891.50 - Rs1,800=Rs91.50 Ans.

Exercise 3(D)

Solution 1:

Cost of machine in 2008 = Rs44,000

Depreciation rate=12%

(i) ∴ Cost of machine at the end of 2009

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

$$= 44,000\left(1 - \frac{12}{100}\right)^2$$

$$= 44,000 \times \left(\frac{88}{100}\right)^2 = Rs34,073.60 \quad \text{Ans.}$$

(ii) Cost of machine at the beginning of 2007(P)

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

$$\Rightarrow 44,000 = P\left(1 - \frac{12}{100}\right)^1$$

$$\Rightarrow 44,000 = P\left(\frac{88}{100}\right)^1$$

$$\Rightarrow P = \frac{44,000 \times 100}{88} = Rs50,000 \quad \text{Ans}$$

Solution 2:

Let x be the value of the article.

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

The value of the article at the end of the 1^{st} year is
X - 10% of x = 0.90x

The value of the article at the end of the 2^{nd} year is
0.90x - 10% of (0.90x) = 0.81x

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

The value of the article at the end of 3^{rd} year is
0.81x + 10% of (0.81x) = 0.891x

The value of the article at the end of 3 years is ₹40,095.

$$0.891x = 40,095$$

$$\Rightarrow x = 45,000$$

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

Solution 3:

Population in 2005(P) = 64,000
Let after n years its population be 74,088(A)
Growth rate= 5% per annum

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

$$\Rightarrow 74,088 = 64,000\left(1 + \frac{5}{100}\right)^n$$

$$\Rightarrow \frac{74,088}{64,000} = \left(\frac{21}{20}\right)^n$$

$$\Rightarrow \frac{9,261}{8,000} = \left(\frac{21}{20}\right)^n$$

$$\Rightarrow \left(\frac{21}{20}\right)^3 = \left(\frac{21}{20}\right)^n$$

On comparing, we get

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

Ans.

Solution 4:

Let the population in the beginning of 1998 = P
The population at the end of 1999 = 2,85,120(A)
r_1 = - 12% and r_2 = +8%

$$\therefore \quad A = P\left(1 - \frac{r_1}{100}\right)\left(1 + \frac{r_2}{100}\right)$$

$$\Rightarrow 2,85,120 = P\left(1 - \frac{12}{100}\right)\left(1 + \frac{8}{100}\right)$$

$$\Rightarrow 2,85,120 = P\left(\frac{22}{25}\right)\left(\frac{27}{25}\right)$$

$$\Rightarrow P = \frac{2,85,120 \times 25 \times 25}{22 \times 27} = 3,00,000 \text{ Ans.}$$

Solution 5:

Let sum of money be Rs P and rate of interest= r%
Money after 1year= Rs16,500
Money after 3years=Rs19,965
For 1year

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

$$\Rightarrow 16,500 = P\left(1+\frac{r}{100}\right)^1 \text{ ----------(1)}$$

For 3years

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

$$\Rightarrow 19,965 = P\left(1+\frac{r}{100}\right)^3 \text{ ----------(2)}$$

Divide eq^n (2) by eq^n (1)

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

$$\Rightarrow \frac{121}{100} = \left(1+\frac{r}{100}\right)^2$$

$$\Rightarrow \left(\frac{11}{10}\right)^2 = \left(1+\frac{r}{100}\right)^2$$

On comparing, we get

$$\frac{11}{10} = 1+\frac{r}{100} \Rightarrow r = 10\% \text{ Ans.}$$

Put value of r in eq^n (1)

$$16,500 = P\left(1+\frac{10}{100}\right)$$

$$\Rightarrow P = \frac{16,500 \times 10}{11} = \text{Rs}15,000 \text{ Ans}$$

Solution 6:

Given: P = Rs7,500 and Time(n)= 2years

Let rate of interest = y%

$$\therefore \text{ S.I. } = \frac{P \times R \times T}{100} = \frac{7,500 \times y \times 2}{100} = Rs150y$$

$$\therefore \text{ C.I. } = P\left(1+\frac{r}{100}\right)^n - P = Rs7,500\left(1+\frac{y}{100}\right)^2 - Rs7,500$$

Given: C.I. -; S.I. = Rs12

$$\Rightarrow 7,500\left(1+\frac{y}{100}\right)^2 - 7,500 - 150y = 12$$

$$\Rightarrow 7,500\left(1+\frac{y^2}{10000}+\frac{2y}{100}\right) - 7,500 - 150y = 12$$

$$\Rightarrow 7,500 + \frac{7,500y^2}{10000} + 150y - 7,500 - 150y = 12$$

$$\Rightarrow \frac{3y^2}{4} = 12$$

$$\Rightarrow y^2 = 16 \quad \Rightarrow y = 4\% \text{ Ans.}$$

Solution 7:

Let Principal be Rs y and rate= r%

<u>According to 1st condition</u>

Amount in 10 years = Rs 3y

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

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

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

<u>According to 2nd condition</u>

Let after n years amount will be Rs 27y

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

$$\Rightarrow 27y = y\left(1+\frac{r}{100}\right)^n$$

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

Put value from first equation

$$\Rightarrow \left[\left(1+\frac{r}{100}\right)^{10}\right]^3 = \left(1+\frac{r}{100}\right)^n$$

On comparing, we get

n = 10 x 3= 30years Ans.

Solution 8:

At the end of the two years the amount is

$$A_1 = P\left(1+\frac{r}{100}\right)^n$$

$$\Rightarrow A_1 = P\left(1+\frac{10}{100}\right)^2$$

Mr. Sharma paid ₹19,360 at the end of the second year.
So for the third year the principal is A_1 - 19,360.
Also he cleared the debt by paying ₹31,944 at the end of the third year.

$$A_2 = P\left(1+\frac{r}{100}\right)^n$$

$$\Rightarrow 31,944 = \left(P\left(1+\frac{10}{100}\right)^2 - 19,360\right)\left(1+\frac{10}{100}\right)^1$$

$$\Rightarrow 29040 = \left(P\left(1+\frac{10}{100}\right)^2 - 19,360\right)$$

$$\Rightarrow P\left(1+\frac{10}{100}\right)^2 = 48,400$$

$$\Rightarrow P = 40,000$$

Mr. Sharma borrowed ₹40,000.

Solution 9:

Let sum of money be RS y

To calculate S.I.

$$S.I. = \frac{P \times R \times T}{100} = \frac{y \times 10 \times 1}{100} = Rs\,\frac{y}{10}$$

To calculate C.I.(compounded half-yearly)

$$\therefore \quad C.I. = P\left[\left(1+\frac{r}{2\times 100}\right)^{n\times 2} - 1\right] = y\left[\left(1+\frac{10}{2\times 100}\right)^{1\times 2} - 1\right]$$

$$= y\left[\left(\frac{21}{20}\right)^2 - 1\right] = \left(\frac{41}{400}\right)y$$

Given : C.I. - S.I = Rs15

$$\Rightarrow \left(\frac{41}{400}\right)y - \frac{y}{10} = 15$$

$$\Rightarrow \frac{y}{400} = 15 \Rightarrow y = Rs6{,}000 \qquad \text{Ans.}$$

Solution 10:

$$x\left(1+\frac{5}{100}\right)^9 = y\left(1+\frac{5}{100}\right)^7$$

$$\Rightarrow \frac{x}{y} = \frac{1}{\left(1+\frac{5}{100}\right)^2}$$

$$\Rightarrow \frac{x}{y} = \frac{400}{441}$$

Exercise 3(E)

Solution 1:

1st case

Given: S.I. = Rs 450; Time = 2 years and Rate = 4%

$$\therefore \quad \text{Principal} = \frac{I \times 100}{R \times T} = \frac{450 \times 100}{4 \times 2} = \text{Rs. } 5625$$

2nd case(compounded half-yearly)

P = ₹5,625; n = 1 year and r = 4%

$$\therefore \quad A = P\left(1 + \frac{r}{2 \times 100}\right)^{n \times 2} = 5{,}625\left(1 + \frac{4}{2 \times 100}\right)^{1 \times 2}$$

$$= 5{,}625\left(\frac{51}{50}\right)^2 = \text{Rs. } 5852.25$$

$$\therefore \quad \text{C.I.} = 5{,}852.25 - 5{,}625 = \text{Rs. } 227.25$$

Solution 2:

Given: P = Rs. 10,800; Time $= 2\frac{1}{2}$ years and Rate = 10% p.a

For 2 years

$$A = P\left(1 + \frac{r}{100}\right)^n = 10{,}800\left(1 + \frac{10}{100}\right)^2 = \text{Rs}13{,}068$$

For ½ year

$$\therefore \quad A = P\left(1 + \frac{r}{2 \times 100}\right)^{n \times 2} = 13{,}068\left(1 + \frac{10}{2 \times 100}\right)^{\frac{1}{2} \times 2}$$

$$= 13{,}068 \times \frac{21}{20} = 13{,}721.40 = \text{Rs.}13721 \text{(nearest rupee)}$$

∴ ₹13,721 - ₹10,800 = ₹2,921

Solution 3:

(i) Present value of machine(P) = ₹97,200
Depreciation rate = 10%

$$\therefore \text{ Value of machine after 2 years } = P\left(1-\frac{r}{100}\right)^n$$

$$= 97,200\left(1-\frac{10}{100}\right)^2$$

$$= 97,200\left(\frac{9}{10}\right)^2$$

$$=₹78732$$

(ii) Present value of machine(A) = ₹97,200
Depreciation rate = 10% and time = 2 years
To calculate the cost 2 years ago

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

$$\Rightarrow 97,200 = P\left(1-\frac{10}{100}\right)^2$$

$$\Rightarrow 97,200 = P\left(\frac{9}{10}\right)^2$$

$$\Rightarrow P = \text{Rs. } 97,200\times\left(\frac{10}{9}\right)^2 = 1,20,000$$

Solution 4:

Let the sum of money lent by both ₹y
For Anuj
P = ₹y ;rate = 8% and time = 2 years

$$\therefore \text{ S.I. } = \frac{P\times R\times T}{100} = \frac{y\times 8\times 2}{100} = \frac{4y}{25}$$

For Rajesh
P = ₹y ;rate = 8% and time = 2 years

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

Given : C.I. -₹64

$$\Rightarrow \frac{104y}{625} - \frac{4y}{25} = 64$$

$$\Rightarrow \frac{4y}{625} = 64 \Rightarrow y = \frac{64\times 625}{4} = \text{Rs.}10,000$$ Interest received by Anuj $= \frac{4\times 10,000}{25} = \text{Rs.}1600$

Interest received by Rajesh $= \frac{104\times 10,000}{625} = \text{Rs. } 1664$

Solution 5:

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

$$\therefore \quad \text{S.I.} = \frac{P \times R \times T}{100} = \frac{4715 \times 5 \times 5}{100} = 1,178.75$$

Then C.I. = ₹1,178.75 x 4 = ₹4,715

Time = 2 years and rate = 5%

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

$$\Rightarrow \quad 4,715 = P\left[\left(1+\frac{5}{100}\right)^{2} - 1\right]$$

$$\Rightarrow \quad 4,715 = P\left(\frac{41}{400}\right)$$

$$\Rightarrow \quad P = \text{Rs}\,\frac{4,715 \times 400}{41} = \text{Rs. } 46,000$$

Solution 6:

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

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

$$\Rightarrow \quad 4,950 = P\left[\left(1+\frac{15}{100}\right)^{1} - 1\right]$$

$$\Rightarrow \quad 4,950 = P\left(\frac{3}{20}\right)$$

$$\Rightarrow \quad P = \frac{4,950 \times 20}{3}$$

$$\Rightarrow \quad P = \text{Rs. } 33,000$$

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

For first 2years

A = ₹33,000; r_1 = 10%

$$\therefore \quad A = P\left(1+\frac{r_1}{100}\right)$$

$$\Rightarrow \quad 33,000 = P\left(1+\frac{10}{100}\right)$$

$$\Rightarrow \quad 33,000 = P\left(\frac{11}{10}\right)$$

$$\Rightarrow \quad P = \frac{33,000 \times 10}{11} = 30,000$$

The sum invested is ₹30,000.

Solution 7:

Let the sum of money be ₹y
and rate = 10% p.a. compounded half yearly
For first 6months

$$\therefore \quad A = P\left(1+\frac{r}{2\times 100}\right)^{n\times 2} = y\left(1+\frac{10}{2\times 100}\right)^{\frac{1}{2}\times 2} = \left(\frac{21}{20}\right)y$$

For first 12 months

$$\therefore \quad A = P\left(1+\frac{r}{2\times 100}\right)^{n\times 2} = y\left(1+\frac{10}{2\times 100}\right)^{1\times 2} = \left(\frac{441}{400}\right)y$$

Given: The difference between the above amounts = ₹189

$$\Rightarrow \left(\frac{441}{400}\right)y - \left(\frac{21}{20}\right)y = 189$$

$$\Rightarrow \left(\frac{21}{400}\right)y = 189$$

$$\Rightarrow y = \frac{189\times 400}{21}$$

y = 3600

Solution 8:

P = ₹86,000;time = 2 years and rate = 5% p.a.
To calculate S.I.

$$\therefore \quad S.I. = \frac{P\times R\times T}{100} = \frac{86,000\times 5\times 2}{100} = \text{Rs. } 8,600$$

To calculate C.I.

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

$$= 86,000\left[\left(1+\frac{5}{100}\right)^{2} - 1\right]$$

$$= 86,000\left(\frac{41}{400}\right) = \text{Rs. } 8,815$$

Profit = C.I. - S.I. = ₹8,815 - ₹8,600 = ₹215

Solution 9:

Let ₹x be the sum of money.
Rate = 5 % p.a. Simple interest = ₹1,200, n = 3years.

$$1,200 = \frac{x \times 5 \times 3}{100}$$

$$\Rightarrow x = \frac{12,00,00}{15}$$

$$\Rightarrow x = 8,000$$

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., n = 3 years

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

$$\Rightarrow A = 8,000\left(1 + \frac{5}{100}\right)^2$$

$$\Rightarrow A = 8,000\,(1.1025)$$

$$\Rightarrow A = 8,820$$

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

$$\Rightarrow C.I. = 8,820 - 8,000$$

$$\Rightarrow C.I. = 820$$

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

Solution 10:

Let x% be the rate of interest.

P = ₹6,000, n = 2 years, A = ₹6,720

i. For the first year

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

$$\Rightarrow 6,720 = 6,000\left(1+\frac{x}{100}\right)^1$$

$$\Rightarrow 6,720 - 6,000 = 60x$$

$$\Rightarrow x = 12$$

The rate of interest is x% = 12%.

ii. The amount at the end of the second year.

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

$$\Rightarrow A = 6,000\left(1+\frac{12}{100}\right)^2$$

$$\Rightarrow A = 6,000\left(\frac{112}{100}\right)^2$$

$$\Rightarrow A = 7,526.40$$

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