

Simple and Compound Interest

Exercise 8.1

Solutions

1. Principal (P) = 4000/-

Rate of Interest (R) = 7.5%

Time (T) = 3 years and 3 months

1 month = $\frac{1}{12}$ year

3 months = $\frac{3}{12}$ year = $\frac{1}{4}$ year

\therefore Time = $3\frac{1}{4}$ years = $\frac{13}{4}$ years

$$\begin{aligned}\text{Simple interest (I)} &= \frac{P \times R \times T}{100} \\ &= \frac{4000 \times \frac{13}{4} \times 7.5}{100}\end{aligned}$$

$$\text{Simple interest (I)} = 975/-$$

Amount = Principal + Interest

$$= 4000 + 975$$

Amount = 4975/-

2. Given

Simple interest (I) = 170.10

Time (T) = 2 years and 3 months

$$(T) = 2\frac{3}{12} = 2\frac{1}{4} = \frac{9}{4} \text{ years}$$

Rate (R) = 6%

$$\begin{aligned}P &= \frac{I \times 100}{R \times T} \\ &= \frac{170.10 \times 100}{6 \times \frac{9}{4}}\end{aligned}$$

$$\text{Principal} = P = 1260/- \quad \therefore \text{Required sum of money} = 1260/-$$

3. Given

$$\text{Principal} = 800/-$$

$$\text{Simple Interest (I)} = 130/-$$

$$\text{Time} = 2 \text{ years and } 6 \text{ months}$$

$$\text{Time} = 2 \cdot \frac{6}{12} = 2 \cdot \frac{1}{2} = \frac{5}{2} \text{ years}$$

$$R = \frac{I \times 100}{P \times T}$$
$$= \frac{130 \times 100}{800 \times \frac{5}{2}}$$

$$R = 6.5\%$$

Hence, the required rate of interest = 6.5% p.a.

4. Given

$$\text{Principal (P)} = \text{₹} 3.3 \text{ Lakhs}$$

$$P = 330000/-$$

$$\text{Rate (R)} = 6.5\%$$

$$\text{Simple Interest (I)} = 75075/-$$

$$\text{Time (T)} = \frac{I \times 100}{P \times R}$$
$$= \frac{75075 \times 100}{330000 \times 6.5}$$

$$T = 3.5 \text{ years}$$

Hence, the required time = 3 years and 6 months.

5. (i) Simple interest (I) = 2356.25/-

Time (T) = $2\frac{1}{2}$ years

T = $\frac{5}{2}$ years

Rate (R) = $7\frac{1}{4}\%$

R = $\frac{29}{4}\%$

$$P = \frac{I \times 100}{T \times R}$$
$$= \frac{2356.25 \times 100}{\frac{5}{2} \times \frac{29}{4}}$$

P = 13,000/-

Hence, The Required Principal is ₹ 13,000/-

(ii) Given

Rate (R) = 4%

Time (T) = 3 years and 3 months

= $3\frac{3}{12} = 3\frac{1}{4} = \frac{13}{4}$

T = $\frac{13}{4}$ years

Final Amount = 11300/-

Final Amount = Principal (P) + Simple interest (I)

$$11300 = P + \frac{PTR}{100}$$

$$11300 = P \left(1 + \frac{TR}{100} \right)$$

$$11300 = P \left(1 + \frac{13 \times 4}{100} \right)$$

$$11300 = P \left(\frac{113}{100} \right)$$

$$P = \frac{11300 \times 100}{113}$$

P = 10,000/-

Hence, The Required Principal is 10,000/-

6. Given

$$\text{Interest Rate (R)} = 13\frac{1}{3} = \frac{40}{3} \%$$

$$\text{Sum Final Amount} = 3 \times \text{Principal (P)}$$

$$P + I = 3P$$

$$I = 3P - P$$

$$I = 2P$$

$$\frac{PTR}{100} = 2P \quad \left(\because I = \frac{PTR}{100} \right)$$

$$T = \frac{200}{R}$$

$$T = \frac{200}{\frac{40}{3}}$$

$$\text{Time} = T = 15 \text{ years}$$

Hence, the required time to triple itself for given interest rate is 15 years.

7. Given

$$\text{Principal (P)} = 4050/-$$

$$\text{Final Amount} = 4576.50/-$$

$$\text{Principal} + \text{Simple Interest} = 4576.50$$

$$4050 + I_1 = 4576.50$$

$$I_1 = 526.50/-$$

$$\text{Time} = 2 \text{ years.}$$

$$I_1 = \frac{P_1 T R}{100}$$

$$526.50 = \frac{4050 \times 2 \times R}{100}$$

$$R = 6.5\% \text{ Per Annum.}$$

Now we have to calculate simple interest for 1 lakh ³.
for 3 years at a rate of 6.5% per annum

$$I_2 = \frac{P_2 T_2 R}{100}$$

$$I_2 = \frac{1,00,000 \times 3 \times 6.5}{100}$$

$$I_2 = 19,500/-$$

$$\begin{aligned} \text{Total Amount} &= P_2 + I_2 \\ &= 1,00,000 + 19,500/- \\ &= 1,19,500/- \end{aligned}$$

∴ Hence, the 1 lakh will amount ₹1,19,500/- for 3 years

8. Let the money invested to be ₹P.

Given

Principal $P_1 = P$

Principal $P_2 = ₹9600$

Rate $R_1 = 7.5\%$

Rate $R_2 = 10\%$

Time $T_1 = 2$ years

Time = 3 years and 6 months

Let Interest = I_1

Time $T_2 = 3\frac{1}{2} = \frac{7}{2}$ years

Let Simple Interest = I_2

$$\text{∴ } I_1 = 2 \times I_2$$

$$\frac{P_1 T_1 R_1}{100} = 2 \times \frac{P_2 T_2 R_2}{100}$$

$$\frac{P \times 2 \times 7.5}{100} = \frac{2 \times 9600 \times \frac{7}{2} \times 10}{100}$$

$$P = ₹4,48,000/- = ₹44,800/-$$

∴ Hence, the required sum of money is ₹44,800/-

Exercise 8.2

1. Given Principal $P = ₹6000/-$

Rate $R = 10\%$

Time $T = 2$ years

$$\begin{aligned}\text{Interest for first year} &= \frac{PTR}{100} \\ &= \frac{6000 \times 10 \times 1}{100} \\ I_1 &= ₹600/-\end{aligned}$$

Amount at the end of the first year = $6000 + 600$
= ₹6600/-

Principal for second year = ₹6600/-

$$\begin{aligned}\text{Interest for second year} &= \frac{PTR}{100} \\ &= \frac{6600 \times 10 \times 1}{100} \\ I_2 &= ₹660\end{aligned}$$

Amount at the end of second year = $6600 + 660$
= ₹7260/-

∴ Compound Interest for 2 years = Final Amount - (original) Principal
= $7260 - 6000$
= ₹1260/-

2.

Principal for first year (P_1) = ₹1875/-

Rate (R) = 4%

Time (T) = 2 years.

$$\begin{aligned}\text{Interest for first year (I)} &= \frac{P_1 \times T \times R}{100} \\ &= \frac{1875 \times 2 \times 4}{100} \\ I_1 &= ₹75/-\end{aligned}$$

$$\begin{aligned} \text{Amount at the end of first year} &= 1875 + 75 \\ &= ₹ 1950/- \end{aligned}$$

$$\text{Principal Amount for Second year } (P_2) = ₹ 1950/-$$

$$\text{Interest for Second year } I_2 = \frac{1950 \times 4}{100}$$

$$I_2 = ₹ 78/-$$

$$\therefore \text{Compound Interest after 2 year} = I_1 + I_2$$

$$= 75 + 78$$

$$= ₹ 153/-$$

\therefore Hence, Salma has to pay ₹ 153 as Compound Interest to the Mahila Samiti.

3.

$$\text{Principal for first year } (P_1) = ₹ 12000$$

$$\text{Rate} = 10\%, \text{ Time} = 3 \text{ years}$$

$$\text{Interest for first year } (I_1) = \frac{12000 \times 10}{100}$$

$$I_1 = ₹ 1200/-$$

$$\begin{aligned} \text{Total amount at the end of first year} &= 12000 + 1200 \\ &= ₹ 13200/- \end{aligned}$$

$$\text{Principal for Second year } (P_2) = ₹ 13200/-$$

$$\text{Interest for Second year } I_2 = \frac{13200 \times 10}{100}$$

$$= ₹ 1320/-$$

Total amount at the end of the Second year

$$\text{is } 13200 + 1320 = ₹ 14520$$

Principal amount for third year = ₹14520

$$\text{Interest for third year } I_3 = \frac{14520 \times 1 \times 10}{100}$$

$$I_3 = ₹1452$$

$$\begin{aligned} \text{Total amount at the end of third year} &= 14520 + 1452 \\ &= ₹15972 \end{aligned}$$

$$\begin{aligned} \text{Compound Interest for 3 years} &= \text{Final amount} - \text{Principal (P)} \\ &= 15972 - 12000 \\ &= ₹3972 \end{aligned}$$

Hence, At the end of 3 years Jacob will get total amount as ₹15972 and Compound interest ₹3972

4.

Given

$$\text{Principal (P)} = ₹46875$$

$$\text{Rate (R)} = 4\%, \text{ Time} = 3 \text{ years}$$

$$\text{Principal amount for first year (P)} = ₹46875$$

$$(i) \text{ Interest for first year (I}_1) = \frac{46875 \times 1 \times 4}{100}$$

$$I_1 = ₹1875$$

$$\begin{aligned} \text{Total amount at the end of first year} &= 46875 + 1875 \\ &= 48750 \end{aligned}$$

$$\text{Principal amount for second year (P)} = ₹48750$$

$$\text{Interest for second year (I}_2) = \frac{48750 \times 4 \times 1}{100}$$

$$I_2 = ₹1950$$

$$(ii) \text{ Total amount at the end of second year}$$

$$= 48750 + 1950$$

$$= ₹50700$$

Principal for third year (P_3) = ₹ 50700

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$$\begin{aligned} \text{(iii) Interest for third year } (I_3) &= \frac{50700 \times 4}{100} \\ &= ₹ 2028 \end{aligned}$$

Hence,

i. The interest for first year = ₹ 1875

ii. The Amount standing to his credit at the end of second year is ₹ 50700

iii. The interest for third year = ₹ 2028

5. Given Principal = ₹ 6000/- , Time = 3 years
Rate = 10%.

Principal amount for first year (P_1) = ₹ 6000

$$\text{Interest for first year } (I_1) = \frac{6000 \times 1 \times 10}{100}$$

$$I_1 = ₹ 600$$

Total amount at the end of first year = 6000 + 600
= ₹ 6600

Principal for second year (P_2) = ₹ 6600

$$\text{(i) Interest for second year } (I_2) = \frac{6600 \times 1 \times 10}{100}$$

$$I_2 = ₹ 660$$

Total amount at the end of second year = 6600 + 660
= ₹ 7260

Principal for third year (P_3) = ₹ 7260

$$\text{Interest for third year } (I_3) = \frac{7260 \times 1 \times 10}{100}$$

$$I_3 = ₹ 726/-$$

$$(ii) \text{ Total amount at the end of third year} = 7260 + 726 \\ = ₹ 7986$$

Hence i. Compound interest for second year = ₹ 660 .

$$∴ \text{ Total amount at the end of the third year} = ₹ 7986$$

6.

$$\text{Principal amount for first year } (P_1) = ₹ 5000$$

$$\text{Rate of interest for first year } (R_1) = 6\%$$

$$\text{Interest for first year} = \frac{5000 \times 1 \times 6}{100}$$

$$(I_1) = ₹ 300$$

$$\text{Total amount at the end of first year} = 5000 + 300 \\ = ₹ 5300/-$$

$$\text{Principal amount for second year } (P_2) = 5300$$

$$\text{Rate of Interest for second year} = 8\%$$

$$\text{Compound Interest for second year} = \frac{5300 \times 1 \times 8}{100}$$

$$(I_2) = ₹ 424$$

$$\text{Total amount at the end of second year} = 5300 + 424 \\ = ₹ 5724$$

$$\text{Compound interest for 2 years} = \text{Final amount} - \text{Principal } (P_1)$$

$$= 5724 - 5000$$

$$= ₹ 724$$

Hence Total amount after 2 year = ₹ 5724

$$\text{Compound interest for 2 year} = ₹ 724$$

7. Given Principal = ₹ 20000

Time = 2 year

Rate of Interest = 8%.

$$\begin{aligned}\text{Simple Interest (I)} &= \frac{PTR}{100} \\ &= \frac{20000 \times 2 \times 8}{100}\end{aligned}$$

$$\text{Simple Interest (I)} = ₹ 3200$$

Simple but Compound Interest as C

$$\text{Interest for first year} = \frac{20000 \times 1 \times 8}{100}$$

$$I_1 = 1600$$

$$\begin{aligned}\text{Total amount at the end of first year} &= 20000 + 1600 \\ &= ₹ 21600\end{aligned}$$

$$\text{Compound Interest for second year} = \frac{21600 \times 1 \times 8}{100}$$

$$(I_2) = ₹ 1728$$

$$\begin{aligned}\therefore \text{Total Compound Interest for 2 year} &= I_1 + I_2 \\ &= 1600 + 1728 \\ C &= 3328\end{aligned}$$

$$\begin{aligned}\therefore \text{Difference between the Compound interest and} \\ \text{Simple interest is } (C - I) &= 3328 - 3200 \\ &= ₹ 128\end{aligned}$$

Exercise 8.3

1.

(i) Given Principal = ₹ 15000

(ii) Time = 2 years ; $n=2$

Rate of interest = 10%

$$\begin{aligned} \text{Amount (A)} &= P \left(1 + \frac{R}{100}\right)^n \\ &= 15000 \left(1 + \frac{10}{100}\right)^2 \end{aligned}$$

Total Amount (A) = 18150

$$\begin{aligned} \text{Compound interest } C &= A - P \\ &= 18150 - 15000 \end{aligned}$$

Compound interest = 3150

Hence, Amount is ₹ 18150 and Compound interest ₹ 3150

(ii) Given Principal (P) = ₹ 156250

Time (n) = $1\frac{1}{2} = \frac{3}{2}$

Rate of Interest (R) = 8% per annum

Compounded half yearly

$$\text{So } R = \frac{8\%}{2} = 4\% \text{ (Half yearly)}$$

$$n = \frac{3/2}{1/2} = 3$$

$$\begin{aligned} \text{Compound interest } A &= P \left(1 + \frac{R}{100}\right)^n \\ &= 156250 \left(1 + \frac{4}{100}\right)^3 \end{aligned}$$

$$A = ₹ 175760$$

$$C.I = A - P \quad \text{7.}$$

$$= 175760 - 156250$$

$$C.I = 19510$$

Hence, Total Amount ₹ 175760 and Compound interest is ₹ 19510

(iii) Given

$P = 100000$, Time = 9 months, $R = 4\%$ p.a.
Compounded for quarterly means 3 months

$$R = \frac{4}{4} = 1\% \text{ per 3 months}$$

$$n = \frac{9 \text{ months}}{3 \text{ months}} = 3.$$

$$\begin{aligned} \text{Amount (A)} &= P \left(1 + \frac{R}{100}\right)^n \\ &= 100000 \left(1 + \frac{1}{100}\right)^3 \end{aligned}$$

$$A = ₹ 103030.1$$

$$\begin{aligned} C &= A - P \\ &= 103030.1 - 100000 \end{aligned}$$

$$C = ₹ 3030.1$$

Hence, Amount ₹ 103030.1 and Compound interest ₹ 3030.1

2. Given

$$\text{Principal (P)} = ₹4800$$

$$\text{Rate of interest (R)} = 5\% \text{ p.a.}, \text{ Time} = 2 \text{ years}$$
$$n = 2$$

$$\text{Simple interest (S.I)} = \frac{PTR}{100}$$
$$= \frac{4800 \times 2 \times 5}{100}$$

$$\text{S.I} = ₹480$$

$$\text{Compound interest (C.I)} = A - P$$

$$\text{Amount (A)} = P \left(1 + \frac{R}{100}\right)^n$$
$$= 4800 \left(1 + \frac{5}{100}\right)^2$$

$$A = ₹5292$$

$$\text{Compound interest C.I} = A - P$$
$$= 5292 - 4800$$

$$\text{C.I} = 492$$

$$\text{Difference between C.I \& S.I} = 492 - 480$$

$$= ₹12$$

3.

$$\text{Principal amount for first year (P)} = ₹3125$$

$$\text{Rate of interest for first year (R)} = 4\%$$

$$\text{Interest for first year (I)} = \frac{3125 \times 4}{100}$$

$$= ₹125$$

3.

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$$\text{Principal (P)} = ₹ 3125$$

$$\text{Rate of interest for first year (R}_1\text{)} = 4\%$$

$$\text{Rate of interest for second year (R}_2\text{)} = 5\%$$

$$\text{Rate of interest for third year (R}_3\text{)} = 6\%$$

$$\begin{aligned} \text{Amount (A)} &= P \left(1 + \frac{R_1}{100}\right) \left(1 + \frac{R_2}{100}\right) \left(1 + \frac{R_3}{100}\right) \\ &= 3125 \left(1 + \frac{4}{100}\right) \left(1 + \frac{5}{100}\right) \left(1 + \frac{6}{100}\right) \end{aligned}$$

$$A = ₹ 3617.25$$

$$\text{Compound Interest (C.I)} = A - P$$

$$= 3617.25 - 3125$$

$$\text{C.I} = ₹ 492.25$$

4.

$$\text{Principal} = ₹ 26400$$

$$\text{Rate of interest (R)} = 15\% \text{ p.a.}$$

$$\text{Time} = 2 \text{ years and 4 months}$$

$$\text{Amount (A)} = P \left(1 + \frac{R}{100}\right)^n \left(1 + \frac{\alpha \cdot R}{100}\right)$$

$$n=2; \alpha = \frac{4}{12} \quad \text{when time is in fraction}$$

$$A = 26400 \left(1 + \frac{15}{100}\right)^2 \left(1 + \frac{\frac{4}{12} \times 15}{100}\right) \quad (\because \alpha < 1)$$

$$A = ₹ 36659.7$$

Hence, Kamala has to pay ₹ 36659.7 to clear the loan

5.

$$\text{Principal (P)} = ₹ 18000$$

$$\text{Rate of interest (R)} = 8\% \text{ p.a.}$$

$$\text{Time} = 2 \text{ year}$$

$$\begin{aligned} \text{Simple interest (S.I)} &= \frac{PTR}{100} \\ &= \frac{18000 \times 2 \times 8}{100} \end{aligned}$$

$$\text{S.I} = 2880$$

$$\text{Compound Interest} = A - P$$

$$\begin{aligned} \text{Amount } A &= P \left(1 + \frac{R}{100}\right)^n \\ &= 18000 \left(1 + \frac{8}{100}\right)^2 \end{aligned}$$

$$A = ₹ 20995.2$$

$$\begin{aligned} \text{Compound interest (C.I)} &= 20995.2 - 18000 \\ &= ₹ 2995.2 \end{aligned}$$

$$\begin{aligned} \text{Difference b/w C.I \& S.I} &= 2995.2 - 2880 \\ &= 115.2 \end{aligned}$$

∴ The extra amount Anil has to pay is ₹ 115.2

6.

Given

$$\text{Principal (P)} = ₹ 75000/-$$

$$\text{Rate of interest} = 12\% \text{ p.a.}$$

(i) Compounded Annually

$$\text{Time} = 1\frac{1}{2} \text{ year}$$

$$n = 1 ; x = \frac{1}{2}$$

$$\begin{aligned} \text{Amount (A)} &= P \left(1 + \frac{R}{100}\right)^n \left(1 + \frac{n \cdot R}{100}\right) \\ &= 75000 \left(1 + \frac{12}{100}\right) \left(1 + \frac{\frac{1}{2} \times 12}{100}\right) \\ A_1 &= ₹ 89040 \end{aligned}$$

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(ii) Compounded half-yearly

$$n = \frac{3/2}{1/2} = 3$$

$$\begin{aligned} A &= P \left(1 + \frac{R}{100}\right)^n \\ &= 75000 \left(1 + \frac{12}{100}\right)^3 \end{aligned}$$

$$A_2 = 105369.6$$

Hence, Mukesh has to pay more when Compounded Half-yearly than that of ^{what} Compounded yearly.

7. Given Principal (P) = 10000

Rate of interest (R) = 7% p.a

(i) Amount received by by Arjman at the end of 2 years

$$\begin{aligned} A &= P \left(1 + \frac{R}{100}\right)^n \\ &= 10000 \left(1 + \frac{7}{100}\right)^2 \end{aligned}$$

$$A_2 = ₹ 11449$$

(ii) interest for 3rd year

Amount received at the end of 3rd year

$$\begin{aligned}A_3 &= P \left(1 + \frac{R}{100}\right)^3 \\&= 10000 \times \left(1 + \frac{7}{100}\right)^3 \\A_3 &= 12250.43\end{aligned}$$

$$\begin{aligned}\text{Interest for 3rd year} &= A_3 - A_2 \\&= 12250.43 - 11449 \\&= ₹801.49\end{aligned}$$

Hence, Arjman receives interest for 3rd year is ₹801.49

8.

Given

$$\text{Amount (A)} = 9261$$

Time = 3 year ; Compounded annually

Rate of interest (R) = 5% p.a

$$n = 3$$

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

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

$$P = \frac{9261}{1.157625}$$

$$P = ₹8000$$

Hence, the sum of money is ₹8000

9. Given

Amount (A) = ₹ 140608

Time = $1\frac{1}{2}$ years

Compounded half-yearly

$n = 3$

Rate of interest = 8% p.a

$R = 4\%$ per half-year

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

$140608 = P \left(1 + \frac{4}{100}\right)^3$

$P = \frac{140608}{1.124}$

$P = ₹ 125000$

Hence the principal amount is ₹ 125000

10. Given

Principal (P) = ₹ 2000

Total Amount (A) = ₹ 2315.25

Time = 3 years ; $n = 3$ (∵ Compounded annually)

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

$2315.25 = 2000 \left(1 + \frac{R}{100}\right)^3$

$1 + \frac{R}{100} = \frac{21}{20}$

$\frac{R}{100} = \frac{1}{20}$

$R = 5\%$ per annum

Hence, Rate interest is 5% per annum

11. Given

$$\text{Principal (P)} = ₹ 40000$$

$$\text{Amount (A)} = ₹ 46305$$

$$\text{Time} = 1\frac{1}{2} \text{ year}$$

Compounded half-yearly

$$n = 3$$

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

$$46305 = 40000 \left(1 + \frac{R}{100}\right)^3$$

$$1 + \frac{R}{100} = \frac{21}{20}$$

$$R = 5\% \text{ per half-year}$$

$$R = 10\% \text{ per Annum.}$$

Hence, Rate of interest 10% per Annum

12. Given

$$\text{Principal} = ₹ 17578$$

$$\text{Amount (A)} = ₹ 17576$$

$$\text{Principal (P)} = ₹ 15625$$

$$\text{Rate of interest} = 4\% \text{ p.a}$$

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

$$17576 = 15625 \left(1 + \frac{4}{100}\right)^n$$

$$1.1248 = (1.04)^n$$

Apply 'log' on both side

$$\log_e(1.1248) = n \cdot \log_e(1.04)$$

$$\boxed{n = 3}$$

Hence, the required time is 3 years

13.

Principal = ₹ 16000

Amount = ₹ 18522

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

Compounded Semi-annually

R = 5% per half-year

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

$$18522 = 16000 \left(1 + \frac{5}{100}\right)^n$$

$$1.1576 = (1.05)^n$$

Apply 'log' on both sides

$$n \cdot \log_e (1.05) = \log_e (1.1576)$$

$$\boxed{n = 3}$$

∴ Time = 3 × 6 months = 1½ years

∴ The required time = 1½ years.