Exercise 8.3

Question 1:

Calculate the amount and compound interest on:

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

(b) ₹ 18,000 for $2\frac{1}{2}$ years at 10% per annum compounded annually.

(c) ₹ 62,500 for $1\frac{1}{2}$ years at 8% per annum compounded annually.

(d) ₹ 8,000 for 1 years at 9% per annum compounded half yearly. (You could the year by year calculation using S.I. formula to verify).

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

Answer 1:

(a) Here, Principal (P) = ₹ 10800, Time (n) = 3 years,

Rate of interest (R) = $12\frac{1}{2}\% = \frac{25}{2}\%$

Amount (A) = $P\left(1+\frac{R}{100}\right)^n = 10800\left(1+\frac{25}{2\times100}\right)^3 = 10800\left(1+\frac{1}{2\times4}\right)^3$

$= 10800\left(1+\frac{1}{8}\right)^3 = 10800\left(\frac{9}{8}\right)^3 = 10800\times\frac{9}{8}\times\frac{9}{8}\times\frac{9}{8}$ = ₹ 15,377.34

Compound Interest (C.I.) = A – P = ₹ 10800 – ₹15377.34 = ₹4,577.34

(b) Here,

Principal (P) = ₹ 18,000, Time (n) = $2\frac{1}{2}$ years, Rate of interest (R) = 10% p.a.

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

$= 18000\left(\frac{11}{10}\right)^2 = 18000\times\frac{11}{10}\times\frac{11}{10}$ = ₹ 21,780

Interest for $\frac{1}{2}$ years on ₹ 21,780 at rate of 10% = $\frac{1}{2}\times\frac{21780\times10\times1}{100}$ = ₹ 1,089

Total amount for $2\frac{1}{2}$ years = ₹ 21,780 + ₹ 1089 = ₹ 22,869

Compound Interest (C.I.) = A – P = ₹ 22869 – ₹ 18000 = ₹ 4,869

(c) Here, Principal (P) = ₹ 62500,

Time (n) = $1\frac{1}{2} = \frac{3}{2}$ years = 3 half-years (compounded half yearly)

Rate of interest (R) = 8% = 4% (compounded half yearly)

Amount (A) = $P\left(1+\frac{R}{100}\right)^n = 62500\left(1+\frac{4}{100}\right)^2 = 62500\left(1+\frac{1}{25}\right)^3$

$$= 62500\left(\frac{26}{25}\right)^3 = 62500\times\frac{26}{25}\times\frac{26}{25}\times\frac{26}{25} = ₹\ 70{,}304$$

Compound Interest (C.I.) = A – P = ₹ 70304 – ₹ 62500 = ₹ 7,804

(d) Here,
Principal (P) = ₹ 8000,
Time (n) = 1 years = 2 half-years(compounded half yearly)
Rate of interest (R) = 9% = $\frac{9}{2}$% (compounded half yearly)

$$\text{Amount (A)} = P\left(1+\frac{R}{100}\right)^n = 8000\left(1+\frac{9}{2\times100}\right)^2 = 8000\left(1+\frac{9}{200}\right)^2$$

$$= 8000\left(\frac{209}{200}\right)^2 = 8000\times\frac{209}{200}\times\frac{209}{200} = ₹\ 8{,}736.20$$

Compound Interest (C.I.) = A – P = ₹ 8736.20 – ₹ 8000 = ₹ 736.20

(e) Here, Principal (P) = ₹ 10,000,
Time (n) = 1 years = 2 half-years (compounded half yearly)
Rate of interest (R) = 8% = 4% (compounded half yearly)

$$\text{Amount (A)} = P\left(1+\frac{R}{100}\right)^n = 10000\left(1+\frac{4}{100}\right)^2 = 10000\left(1+\frac{1}{25}\right)^2$$

$$= 10000\left(\frac{26}{25}\right)^2 = 10000\times\frac{26}{25}\times\frac{26}{25} = ₹\ 10{,}816$$

Compound Interest (C.I.) = A – P = ₹ 10,816 – ₹ 10,000 = ₹ 816

Question 2:

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

Answer 2:

Here, Principal (P) = ₹ 26,400,
Time (n) = 2 years 4 months, Rate of interest (R) = 15% p.a.

$$\text{Amount for 2 years (A)} = P\left(1+\frac{R}{100}\right)^n = 26400\left(1+\frac{15}{100}\right)^2 = 26400\left(1+\frac{3}{20}\right)^2$$

$$= 26400\left(\frac{23}{20}\right)^2 = 26400\times\frac{23}{20}\times\frac{23}{20} = ₹\ 34{,}914$$

Interest for 4 months = $\frac{4}{12}=\frac{1}{3}$ years at the rate of 15% $= \frac{1}{3}\times\frac{34914\times15\times1}{100}$

$= ₹\ 1745.70$

$\therefore$ Total amount = ₹ 34,914 + ₹ 1,745.70 = ₹ 36,659.70

Question 3:

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

Answer 3:

Here, Principal (P) = ₹ 12,500, Time (T) = 3 years, Rate of interest (R) = 12% p.a.

Simple Interest for Fabina = $\frac{P \times R \times T}{100} = \frac{12500 \times 12 \times 3}{100}$ = ₹ 4,500

Amount for Radha, P = ₹ 12,500, R = 10% and n = 3 years

Amount (A) $= P\left(1+\frac{R}{100}\right)^n = 12500\left(1+\frac{10}{100}\right)^3 = 12500\left(1+\frac{1}{10}\right)^3$

$= 12500\left(\frac{11}{10}\right)^3 = 12500 \times \frac{11}{10} \times \frac{11}{10} \times \frac{11}{10}$ = ₹ 16,637.50

∴ C.I. for Radha = A – P = ₹ 16,637.50 – ₹ 12,500 = ₹ 4,137.50

Here, Fabina pays more interest = ₹ 4,500 – ₹ 4,137.50 = ₹ 362.50

Question 4:

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

Answer 4:

Here, Principal (P) = ₹12,000, Time (T) = 2 years, Rate of interest (R) = 6% p.a.

Simple Interest = $\frac{P \times R \times T}{100} = \frac{12000 \times 6 \times 2}{100}$ = ₹ 1,440

Had he borrowed this sum at 6% p.a., then

Compound Interest $= P\left(1+\frac{R}{100}\right)^n - P = 12000\left(1+\frac{6}{100}\right)^2 - 12000$

$= 12000\left(1+\frac{3}{50}\right)^2 - 12000 = 12000\left(\frac{53}{50}\right)^2 - 12000$

$= 12000 \times \frac{53}{50} \times \frac{53}{50} - 12000$ = ₹ 13,483.20 – ₹ 12,000

= ₹ 1,483.20

Difference in both interests = ₹ 1,483.20 – ₹ 1,440.00 = ₹ 43.20

Question 5:

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

(i) after 6 months?

(ii) after 1 year?

Answer 5:

Here, Principal (P) = ₹ 60,000,

Time (n) = 6 months = 1 half-year (compounded half yearly)

Rate of interest (R) = 12% = 6% (compounded half yearly)

$$\text{Amount (A)} = P\left(1+\frac{R}{100}\right)^{n} = 60000\left(1+\frac{6}{100}\right)^{1} = 60000\left(1+\frac{3}{50}\right)^{1}$$

$$= 60000\left(\frac{53}{50}\right)^{1} = 60000\times\frac{53}{50} = ₹\ 63{,}600$$

After 6 months Vasudevan would get amount ₹ 63,600.

(ii) Here, Principal (P) = ₹ 60,000,
Time (n) = 1 year = 2 half-years (compounded half yearly)
Rate of interest (R) = 12% = 6% (compounded half yearly)

$$\text{Amount (A)} = P\left(1+\frac{R}{100}\right)^{n} = 60000\left(1+\frac{6}{100}\right)^{2} = 60000\left(1+\frac{3}{50}\right)^{2}$$

$$= 60000\left(\frac{53}{50}\right)^{2} = 60000\times\frac{53}{50}\times\frac{53}{50} = ₹\ 67{,}416$$

After 1 year Vasudevan would get amount ₹ 67,416.

Question 6:

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

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

Answer 6:

(i) Here,

Principal (P) = ₹ 80,000, Time (n) = $1\frac{1}{2}$ years, Rate of interest (R) = 10%

$$\text{Amount for 1 year (A)} = P\left(1+\frac{R}{100}\right)^{n} = 80000\left(1+\frac{10}{100}\right)^{1} = 80000\left(1+\frac{1}{10}\right)^{1}$$

$$= 80000\left(\frac{11}{10}\right)^{1} = ₹\ 88{,}000$$

$$\text{Interest for } \frac{1}{2} \text{ year} = \frac{88000\times10\times1}{100\times2} = ₹\ 4{,}400$$

Total amount = ₹ 88,000 + ₹ 4,400 = ₹ 92,400

(ii) Here, Principal (P) = ₹ 80,000,
Time (n) = $1\frac{1}{2}$ year = 3 half-years (compounded half yearly)
Rate of interest (R) = 10% = 5% (compounded half yearly)

$$\text{Amount (A)} = P\left(1+\frac{R}{100}\right)^{n} = 80000\left(1+\frac{5}{100}\right)^{3} = 80000\left(1+\frac{1}{20}\right)^{3}$$

$$= 80000\left(\frac{21}{20}\right)^{3} = 80000\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20} = ₹\ 92{,}610$$

Difference in amounts = ₹ 92,610 – ₹ 92,400 = ₹ 210

Question 7:

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

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

(ii) The interest for the third year.

Answer 7:

(i) Here,

Principal (P) = ₹ 8000, Rate of Interest (R) = 5%, Time (n) = 2 years

$$\text{Amount (A)} = P\left(1+\frac{R}{100}\right)^n = 8000\left(1+\frac{5}{100}\right)^2 = 8000\left(1+\frac{1}{20}\right)^2$$

$$= 8000\left(\frac{21}{20}\right)^2 = 8000\times\frac{21}{20}\times\frac{21}{20} = ₹\ 8{,}820$$

(ii) Here, Principal (P) = ₹ 8000, Rate of Interest (R) = 5%, Time (n) = 3 years

$$\text{Amount (A)} = P\left(1+\frac{R}{100}\right)^n = 8000\left(1+\frac{5}{100}\right)^3 = 8000\left(1+\frac{1}{20}\right)^3$$

$$= 8000\left(\frac{21}{20}\right)^3 = 8000\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20} = ₹\ 9{,}261$$

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

Question 8:

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

Answer 8:

Here, Principal (P) = ₹ 10000,

Rate of Interest (R) = 10% = 5% (compounded half yearly)

Time (n) = $1\frac{1}{2}$ years = 3 half-years (compounded half yearly)

$$\text{Amount (A)} = P\left(1+\frac{R}{100}\right)^n = 10000\left(1+\frac{5}{100}\right)^3 = 10000\left(1+\frac{1}{20}\right)^3$$

$$= 10000\left(\frac{21}{20}\right)^3 = 10000\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20} = ₹\ 11{,}576.25$$

Compound Interest (C.I.) = A – P = ₹ 11,576.25 – ₹ 10,000 = ₹ 1,576.25

If it is compounded annually, then

Here, Principal (P) = ₹ 10000, Rate of Interest (R) = 10%, Time (n) = $1\frac{1}{2}$ years

$$\text{Amount (A) for 1 year} = P\left(1+\frac{R}{100}\right)^n = 10000\left(1+\frac{10}{100}\right)^1 = 10000\left(1+\frac{1}{10}\right)^1$$

$$= 10000\left(\frac{11}{10}\right)^1 = 10000\times\frac{11}{10} = ₹\ 11{,}000$$

Interest for $\frac{1}{2}$ year $= \frac{11000\times1\times10}{2\times100}$ = ₹ 550

$\therefore$ Total amount = ₹ 11,000 + ₹ 550 = ₹ 11,550

Now, C.I. = A – P = ₹ 11,550 – ₹ 10,000 = ₹ 1,550

Yes, interest ₹ 1,576.25 is more than ₹ 1,550.

Question 9:

Find the amount which Ram will get on ₹ 4,096, if he gave it for 18 months at $12\frac{1}{2}\%$ per annum, interest being compounded half yearly.

Answer 9:

Here, Principal (P) = ₹ 4096,

Rate of Interest (R) = $12\frac{1}{2} = \frac{25}{2}\% = \frac{25}{4}\%$ (compounded half yearly)

Time (n) = 18 months = $1\frac{1}{2}$ years = 3 half-years (compounded half yearly)

$$\text{Amount (A)} = P\left(1+\frac{R}{100}\right)^n = 4096\left(1+\frac{25}{4\times100}\right)^3 = 4096\left(1+\frac{1}{4\times4}\right)^3$$

$$= 4096\left(\frac{17}{16}\right)^3 = 4096\times\frac{17}{16}\times\frac{17}{16}\times\frac{17}{16} = ₹\ 4{,}913$$

Question 10:

The population of a place increased to 54,000 in 2003 at a rate of 5% per annum.

(i) Find the population in 2001.

(ii) What would be its population in 2005?

Answer 10:

(i) Here, A_{2003} = 54,000, R = 5%, n = 2 years

Population would be less in 2001 than 2003 in two years.

Here population is increasing.

$$\therefore \quad A_{2003} = P_{2001}\left(1+\frac{R}{100}\right)^n \Rightarrow 54000 = P_{2001}\left(1+\frac{5}{100}\right)^2$$

$$\Rightarrow 54000 = P_{2001}\left(1+\frac{1}{20}\right)^2 \Rightarrow 54000 = P_{2001}\left(\frac{21}{20}\right)^2$$

$$\Rightarrow 54000 = P_{2001}\times\frac{21}{20}\times\frac{21}{20} \Rightarrow P_{2001} = \frac{54000\times20\times20}{21\times21}$$

$$\Rightarrow P_{2001} = 48{,}980 \text{ (approx.)}$$

(ii) According to question, population is increasing.

Therefore population in 2005,

$$A_{2005} = P\left(1+\frac{R}{100}\right)^n = 54000\left(1+\frac{5}{100}\right)^2 = 54000\left(1+\frac{1}{20}\right)^2$$

$$= 54000\left(\frac{21}{20}\right)^2 = 54000\times\frac{21}{20}\times\frac{21}{20} = 59{,}535$$

Hence population in 2005 would be 59,535.

Question 11:

In a laboratory, the count of bacteria in a certain experiment was increasing at the rate of 2.5% per hour. Find the bacteria at the end of 2 hours if the count was initially 5,06,000.

Answer 11:

Here, Principal (P) = 5,06,000, Rate of Interest (R) = 2.5%, Time (n) = 2 hours

After 2 hours, number of bacteria,

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

$$= 506000\left(1+\frac{2.5}{100}\right)^{2}$$

$$= 506000\left(1+\frac{25}{1000}\right)^{2}$$

$$= 506000\left(1+\frac{1}{40}\right)^{2}$$

$$= 506000\left(\frac{41}{40}\right)^{2}$$

$$= 506000\times\frac{41}{40}\times\frac{41}{40} = 5,31,616.25$$

Hence, number of bacteria after two hours are 531616 (approx.).

Question 12:

A scooter was bought at ₹ 42,000. Its value depreciated at the rate of 8% per annum. Find its value after one year.

Answer 12:

Here, Principal (P) = ₹ 42,000, Rate of Interest (R) = 8%, Time (n) = 1 years

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

$$= 42000\left(1-\frac{8}{100}\right)^{1}$$

$$= 42000\left(1+\frac{2}{25}\right)^{1}$$

$$= 42000\left(\frac{27}{25}\right)^{1}$$

$$= 42000\times\frac{27}{25} = ₹\ 38,640$$

Hence, the value of scooter after one year is ₹ 38,640.