14. Compound Interest

1. Today's population of one city is 2,16,000. Population increases every year at the rate 5% what will be total population of same city after two years?

Solution:

Here, A = Population after two years,

P = Today's population = 2,16,000 ,

R = Rate increase of the population = 5% ,

N = Period = 2 years

$$\text{Population after 2 years} = A = P \times \left(1 + \frac{R}{100}\right)^N$$

$$= 216000 \times \left(1 + \frac{5}{100}\right)^2$$

$$= 216000 \times \left(\frac{21}{20}\right)^2$$

$$= 216000 \times \frac{21}{20} \times \frac{21}{20}$$

$$= 216000 \times \frac{441}{400}$$

$$= 238140$$

∴ The population of the city after 2 years will be 2,38,140.

2. There are 15,625 trees in a park. If the target of plantation is decided to be 8% per year. Then how many trees will be there in the park after 3 years?

Solution :

Number of trees initially = P = 15625

Rate of increase in trees = R = 8%

Period = N = 3 years

$$\therefore \text{Number of trees after 3 years} = A = P \times \left(1 + \frac{R}{100}\right)^N$$

$$= 15625 \times \left(1 + \frac{8}{100}\right)^3$$

$$= 15625 \times \left(1 + \frac{2}{25}\right)^3$$

$$= 15625 \times \left(\frac{27}{25}\right)^3$$

$$= 15625 \times \frac{27}{25} \times \frac{27}{25} \times \frac{27}{25}$$

$$= 27 \times 27 \times 27$$

$$= 19683$$

∴ There would be 19,683 trees after 3 years in the park.

3. In a company there were 6400 employees initially. The number of employees decreased by 25% every year. Find the number of employees after 3 years?

Solution :

Number of employees = P = 6400

Rate of decrease in employees = R = 25%

The number of employees decreased by 25% every year.

$\therefore R = -25$

Period = N = 2 years

∴ Number of employees after 2 years = A

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

$$= 6400 \times \left(1 + \frac{(-25)}{100}\right)^2$$

$$= 6400 \times \left(1 - \frac{1}{4}\right)^2$$

$$= 6400 \times \left(\frac{3}{4}\right)^2$$

$$= 6400 \times \frac{3}{4} \times \frac{3}{4}$$

$$= 3600$$

∴ There will be 3600 employees after 2 years.

4. Sagar purchased a machine 3 years ago for Rs. 78125. If the cost of that machine decreases at 8% per year, what will be its value at present?

Solution :

Cost of machine after decreasing = A

Original cost of machine = P = Rs.78125

Rate of decrease price = R = 8%

Period = N = 3 years

Cost of machine after decreasing = A = $P \times \left(1 + \frac{R}{100}\right)^N$

$$= 78125 \times \left(1 + \frac{(-8)}{100}\right)^3$$

$$= 78125 \times \left(1 - \frac{2}{25}\right)^3$$

$$= 78125 \times \left(\frac{23}{25}\right)^3$$

$$= 78125 \times \frac{23}{25} \times \frac{23}{25} \times \frac{23}{25}$$

$$= 3125 \times 23 \times \frac{23}{25} \times \frac{23}{25}$$

$$= 125 \times 23 \times 23 \times \frac{23}{25}$$

$$= 5 \times 23 \times 23 \times 23$$

$$= 5 \times 12167$$

$$= 60835$$

∴ The present cost price of a machine will be Rs. 60,835 .

5. The annual interest on a certain amount, interest compounded annually for the two years and the three years is Rs. 48360 and Rs. 48360 respectively. Find the rate of interest annually.

Solution :

The total amount after two years is Rs. 46,500.

Amount = A = Rs. 46,500

Duration = N = 2 years

∴ We find the interest rate for 2 years, we get,

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

$$\therefore 46500 = P \times \left(1 + \frac{R}{100}\right)^{2} \text{ .....(I)}$$

Now, we find the interest rate for 3 years,

A = Rs. 48360, Duration = N = 3 years

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

$$\therefore 48360 = P \times \left(1 + \frac{R}{100}\right)^{3} \text{ ..... (II)}$$

Let us equation (II) ÷ equation (I)

$$\therefore \frac{48360}{46500} = \frac{P \times \left(1+\frac{R}{100}\right)^{3}}{P \times \left(1+\frac{R}{100}\right)^{2}}$$

$$\therefore \frac{48360}{46500} = 1 + \frac{R}{100}$$

$$\therefore \frac{R}{100} = \frac{48360}{46500} - 1$$

$$\therefore \frac{R}{100} = \frac{48360 - 46500}{46500}$$

$$\therefore \frac{R}{100} = \frac{1860}{46500}$$

$$= \frac{186}{4650}$$

$$= \frac{31}{775}$$

$\therefore \frac{R}{100} = \frac{1}{25}$

$\therefore R = \frac{100}{25}$

$\therefore R = 4$

∴ Annually Interest rate is 4%.

6. The two years ago Balasaheb started business by investing Rs.1,44,000. If he increased his capital every year by 10% then what is the total capital in business today?

Solution :

Original capital = P = Rs. 144000 ,

Rate of increase = R = 10,

Duration = N = 2 years

$\therefore$ Today's capital $= P \times \left(1 + \frac{R}{100}\right)^N$

$= 144000 \times \left(1 + \frac{10}{100}\right)^2$

$= 144000 \times \left(1 + \frac{1}{10}\right)^2$

$= 144000 \times \left(\frac{11}{10}\right)^2$

$= 144000 \times \frac{11}{10} \times \frac{11}{10}$

$= 174240$

∴ Today's capital in business is Rs. 1,74,240.

7. The car is valued at Rs. 768000. If its value falls at the rate 2.5% per year, what will be its value after 3 years?

Solution :

Cost of a car initially = P = Rs. 768000

The rate of depreciation is 2.5% per year.

$\therefore$ **Rate of depreciation = R = − 2.5%, Duration = N = 3 years**

$$\therefore \text{Cost of a car after 3 years} = A = P \times \left(1 + \frac{R}{100}\right)^N$$

$$= 768000 \times \left(1 + \frac{-2.5}{100}\right)^3$$

$$= 768000 \times \left(1 - \frac{25}{1000}\right)^3$$

$$\ldots\ldots\left[\frac{2.5}{100} = \frac{25}{1000}\right]$$

$$= 768000 \times \left(1 - \frac{1}{40}\right)^3$$

$$= 768000 \times \left(\frac{39}{40}\right)^3$$

$$= 768000 \times \frac{39}{40} \times \frac{39}{40} \times \frac{39}{40}$$

$$= 12 \times 39 \times 39 \times 39$$

$$= 711828$$

∴ The value of a car after 3 years will be Rs.7,11,828 .

8. Shailesh and Shridhar both have taken a loan of Rs. 8410 at the rate 5 %. If the amount received by Shailesh after 3 years and amount received by Shridhar after 5 years is same. Find investment of each.

Solution :

Suppose the investment of Shridhar be x .

∴ Investment of Shailesh = Rs. $(8410 - x)$

Rate of loan interest for Shailesh = R = 5

Duration of a loan for Shailesh = N = 3 years

$$\therefore \text{Shailesh's investment (A)} = P \times \left(1 + \frac{R}{100}\right)^N$$

$$= (8410 - x) \times \left(1 + \frac{5}{100}\right)^3 \ldots\ldots\ldots\text{(I)}$$

Rate of loan interest for Shridhar = R = 5

Duration of a loan for Shridhar = N = 5 years

$$\therefore \text{Shridhar's investment (A)} = P \times \left(1 + \frac{R}{100}\right)^N$$

$$= x \times \left(1 + \frac{5}{100}\right)^5 \ldots\ldots\ldots\text{(II)}$$

But the amount received by Shailesh after 3 years and amount received by Shridhar after 5 years is same.

$$\therefore (8410 - x) \times \left(1 + \frac{5}{100}\right)^3 = x \times \left(1 + \frac{5}{100}\right)^5$$

……. [From eq^n. (I) and (II)]

$$\therefore (8410 - x) = x \times \left[\left(1 + \frac{5}{100}\right)^{5-3}\right]$$

$$\therefore 8410 - x = x \times \left(1 + \frac{5}{100}\right)^{2}$$

$$\therefore 8410 - x = x \times \left(1 + \frac{1}{20}\right)^{2}$$

$$\therefore 8410 - x = x \times \left(\frac{21}{20}\right)^{2}$$

$$\therefore 8410 - x = x \times \frac{441}{400}$$

$$\therefore \frac{441}{400} \times (x + x) = 8410$$

$$\therefore \frac{441}{400} \times 2x = 8410$$

$$\therefore \frac{841}{400} \times x = 8410$$

$$\therefore x = 8410 \times \frac{400}{841}$$

$$\therefore x = 10 \times 400$$

$$\therefore x = 4000$$

$\therefore$ Shridhar's investment $= x =$ Rs. 4000

$\therefore$ Shailesh's investment $= 8410 - x$

$= 8410 - 4000$

$=$ Rs. 4410

∴ **Shailesh's and Shridhar's investment is Rs. 4410 and Rs. 4000 respectively.**

9. Arjun borrowed Rs. 60,000 from bank at the rate of 5 p.c.p.a. and agree to repay in two years with equal monthly instalment. Then how much amount he has to pay every month?

Solution :

Here, P = Rs. 60000, R = 5, N = 2 years

First we have to find amount for 2 years,

$$\therefore \text{Amount paid in 2 years} = P \times \left(1 + \frac{R}{100}\right)^{N}$$

$$= 60000 \times \left(1 + \frac{5}{100}\right)^{2}$$

$$= 60000 \times \left(1 + \frac{1}{20}\right)^{2}$$

$$= 60000 \times \left(\frac{21}{20}\right)^{2}$$

$$= 60000 \times \frac{21}{20} \times \frac{21}{20}$$

$$= 60000 \times \frac{441}{400}$$

$$= 150 \times 441$$

$$= 66150$$

$$\therefore \text{Amount paid in 1 year} = \frac{66150}{2} = 33075$$

Arjun agree to repay in two years with equal monthly instalment.

$$\therefore \text{Amount paid in per month} = \frac{\text{Amount paid in 1 year}}{12}$$

$$= \frac{33075}{12}$$

$$= 2756.25$$

∴ Arjun paid Rs. 2756.25 per month.

10. Sahebrao borrowed Rs. 25000. He agree to pay interest at the rate of 2%, 3 % and 4 % for first year, second year and third year respectively. What amount should he repay at the end of third year?

Solution :

Principal = P = Rs. 25000

Rate of interest for first year = $R_1 = 2$

Rate of interest for second year = $R_2 = 3$

Rate of interest for third year = $R_3 = 4$

Period = N = 1.

$$\text{Amount for first year } (A_1) = P \times \left(1 + \frac{R_1}{100}\right)^N$$

$$= 25000 \times \left(1 + \frac{2}{100}\right)^1$$

$$\text{Amount for second year } (A_2) = P \times \left(1 + \frac{R_2}{100}\right)^N$$

$$= 25000 \times \left(1 + \frac{3}{100}\right)^1$$

Amount for third year (A_3) $= P \times \left(1 + \frac{R_3}{100}\right)^N$

$= 25000 \times \left(1 + \frac{4}{100}\right)^1$

Amount paid at the end of third year = $A = A_1 \times A_2 \times A_3$

$= \left[25000\left(1 + \frac{2}{100}\right)\right] \times \left[25000\left(1 + \frac{3}{100}\right)\right] \times \left[25000\left(1 + \frac{4}{100}\right)\right]$

$= 25000\left[\left(1 + \frac{2}{100}\right)\left(1 + \frac{3}{100}\right)\left(1 + \frac{4}{100}\right)\right]$

$= 25000 \times \frac{102}{100} \times \frac{103}{100} \times \frac{104}{100}$

$= \frac{102 \times 103 \times 13}{5}$

$= 27315.6$

∴ **Sahebrao should repay Rs. 27315.60 at the end of third year.**

11. The population of a suburb is 55,000. The population increases in the first year by 10 %, in the second year by 6 % and decreases in the third year by 10 %. What will be the population of suburb at the end of three years?

Solution :

Initial population = P = 55000

Population increases in the first year by 10 %.

Population for the first year $= P \times \left(1 + \frac{10}{100}\right)^1$

$= 55000 \times \left(\frac{110}{100}\right)$

Population increases in the second year by 6 %.

Population for the second year $= P \times \left(1 + \frac{6}{100}\right)^1$

$= 55000 \times \left(\frac{106}{100}\right)$

Population decreases in the third year by 10 %.

Population for the third year $= P \times \left(1 - \frac{10}{100}\right)^1$

$= 55000 \times \left(\frac{90}{100}\right)$

∴ Population after three years = Population for the first year × Population for the second year × Population for the third year

$= \left[55000\left(\frac{110}{100}\right) \times 55000\left(\frac{106}{100}\right) \times 55000\left(\frac{90}{100}\right)\right]$

$= 55000\left[\frac{110}{100} \times \frac{106}{100} \times \frac{90}{100}\right]$

$= \frac{55 \times 11 \times 106 \times 9}{10}$

$= \frac{577170}{10}$

$= 57717$

∴ The population of suburb at the end of 3 years should be $57,717$.

12. Find the compound interest on Rs. 30000 at the rate of 16 p.c.p.a. for 3 years.

Solution :

Here, P = Rs. 30000, R = 16 % , N = 3 years

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

$$= 30000 \times \left(1 + \frac{16}{100}\right)^3$$

$$= 30000 \times \left(\frac{116}{100}\right)^3$$

$$= 30000 \times \frac{116}{100} \times \frac{116}{100} \times \frac{116}{100}$$

$$= \frac{3 \times 116 \times 116 \times 116}{100}$$

$$= \frac{4682688}{100}$$

$$= 46826.88$$

∴ Compound interest for 3 years (I) = Amount − Principal

$= 46826.88 - 30000$

$= 16826.88$

$\therefore$ The compound interest will be Rs. 16826.88 after 3 years.

13. The amount of a certain principal is Rs.14,400 in 2 years, compounded annually at the rate of 20 p.c.p.a. Find the principal.

Solution :

Here, A = Rs. 14,400 , R = 20 p.c.p.a. , N = 2 years

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

$$\therefore 14400 = P \times \left(1 + \frac{20}{100}\right)^2$$

$$= P \times \left(\frac{120}{100}\right)^2$$

$$= P \times \left(\frac{6}{5}\right)^2$$

$$= P \times \frac{6}{5} \times \frac{6}{5}$$

$$\therefore P = \frac{14400 \times 5 \times 5}{6 \times 6}$$

$= 10{,}000$

$\therefore$ The principal is Rs. 10,000 .

14. Rs. 8000 amounts to Rs. 10580 in 2 years. Find the rate of interest, if the interest is compounded annually.

Solution :

Here, P = Rs. 8000 , A = Rs. 10580 , N = 2 years

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

$$\therefore 10580 = 8000 \times \left(1 + \frac{R}{100}\right)^2$$

$$\therefore 10580 = 8000 \times \left(\frac{100 + R}{100}\right)^2$$

$$= 8000 \times \frac{(100 + R)^2}{10000}$$

$$= \frac{4(100 + R)^2}{5}$$

$$\therefore \frac{10580 \times 5}{4} = (100 + R)^2$$

$$\therefore 2645 \times 5 = (100 + R)^2$$

$$\therefore 13225 = (100 + R)^2$$

$$\therefore 25 \times 529 = (100 + R)^2$$

$$\therefore 5 \times 23 = 100 + R \text{ ……..(Taking square root on both sides)}$$

$$115 = 100 + R$$

$\therefore$ R = 115 – 100

$\therefore$ R = 15

$\therefore$ The rate of compound interest is 15 p.c.p.a.

15. Find the compound interest of Rs. 12000 at the rate of 15 p.c.p.a. for 2 years and 4 months.

Solution :

Here, P = Rs.12,000 , R = 15%, N = 2 years and 4 month

First find the compound interest for 2 years.

$$\text{Amount for 2 years (A)} = P \times \left(1 + \frac{R}{100}\right)^{N}$$

$$= 12000 \times \left(1 + \frac{15}{100}\right)^{2}$$

$$= 12000 \times \left(1 + \frac{3}{20}\right)^{2}$$

$$= 12000 \times \left(\frac{23}{20}\right)^{2}$$

$$= 12000 \times \frac{23}{20} \times \frac{23}{20}$$

$$= 30 \times 23 \times 23$$

$\therefore$ Amount for 2 years (A) = 15870

Compound interest for 2 years = Amount − Principal

$= 15870 - 12000$

$= 3870$

Here, the interest rate is 15 % for one year.

∴ The interest rate of 4 months $= 15 \times \frac{4}{12} = 5\%$

∴ Interest for 4 months $= 15870 \times \frac{5}{100}$

$= \frac{1587}{2}$

$= 793.50$

∴ Compound interest for 2 years and 4 months = 3870 + 793.50

= 4663.50

∴ Compound interest for 2 years and 4 months is Rs. 4663.50.

16. A library has 6000 books. Every year number of books increases by 10%. Find the number of books after 2 years in a library.

Solution :

Here, the number of books initially in library = P = 6000

The number of books increases by 10% .

∴ R = 10%

Period = N = 2 years

Number of books after 2 years $= P \times \left(1 + \frac{R}{100}\right)^N$

$$= 6000 \times \left(1 + \frac{10}{100}\right)^2$$

$$= 6000 \times \left(1 + \frac{1}{10}\right)^2$$

$$= 6000 \times \left(\frac{11}{10}\right)^2$$

$$= 6000 \times \frac{11}{10} \times \frac{11}{10}$$

$$= 60 \times 11 \times 11$$

$$= 7260$$

∴ 7260 books should be available in the library after 2 years.

17. Dnyaneshwari repaid borrowed amount after two years. If she paid total amount Rs. 22050 under compound interest at the rate of 5%. Find how much money he borrowed?

Complete the following activity:

Dnyaneshwari repaid borrowed amount = A = Rs. ☐

Rate of compound interest = R = ☐ %

Duration = N = ☐ years

Let us write the formula to find out the repaid borrowed amount under compound interest,

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

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

$$\square = P\left(1+\frac{\square}{20}\right)^{\square}$$

$$\square = P\left(\frac{21}{20}\right)^{\square}$$

$$\therefore P = \frac{\square \times 20 \times 20}{21 \times 21}$$

$$\therefore P = \square$$

∴ Dnyaneshwari repaid borrowed amount = Rs. ☐

Solution :

Dnyaneshwari repaid borrowed amount = A = Rs. 22050

Rate of compound interest = R = 5 %

Duration = N = 2 years

Let us write the formula to find out the repaid borrowed amount under compound interest,

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

$$22050 = P\left(1+\frac{5}{100}\right)^{2}$$

$$\boxed{22050} = P\left(1+\frac{\boxed{1}}{20}\right)^{\boxed{2}}$$

$$\boxed{22050} = P\left(\frac{21}{20}\right)^{\boxed{2}}$$

$$\therefore P = \frac{\boxed{22050}\times 20\times 20}{21\times 21}$$

$$\therefore P = \boxed{20000}$$

∴ Dnyaneshwari repaid borrowed amount = Rs. $\boxed{20,000}$

18. If Rs. 5000 amounts to Rs. 5408 in few years, find the duration of investment, if the rate of interest is 4 p.c.p.a. compounded annually.

Solution :

Principal P = Rs. 5000, Rate = R = 4 p.c.p.a. ,

Amount = A = Rs. 5408

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

$$\therefore 5408 = 5000\times\left(1+\frac{4}{100}\right)^{N}$$

$$\therefore 5408 = 5000\times\left(1+\frac{1}{25}\right)^{N}$$

$$\therefore 5408 = 5000\left(\frac{26}{25}\right)^{N}$$

$\therefore \left(\frac{26}{25}\right)^{N} = \frac{5408}{5000}$

$\therefore \left(\frac{26}{25}\right)^{N} = \frac{676}{625}$ **…..(Dividing by 8)**

$\therefore \left(\frac{26}{25}\right)^{N} = \left(\frac{26}{25}\right)^{2}$

$\therefore$ **N = 2**

$\therefore$ **The required compound interest would be Rs. 5408 in 2 years.**

19. Find the difference between the simple interest and compound interest on Rs. 15000 at 10 p.c.p.a. for 3 years.

Solution :

Principal = P = Rs.15000, Rate = R = 10 p.c.p.a. ,

Period = N = 3 years

First find the compound interest,

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

$$= 15000 \times \left(1 + \frac{10}{100}\right)^{3}$$

$$= 15000 \times \left(1 + \frac{1}{10}\right)^{3}$$

$$= 15000 \left(\frac{11}{10}\right)^{3}$$

$$= 15000 \times \frac{11}{10} \times \frac{11}{10} \times \frac{11}{10}$$

$$= 15 \times 11 \times 11 \times 11$$

$$= 19965$$

∴ Amount = A = 19965

∴ Compound interest = Amount − Principal

= 19965 – 15000

= 4965

Now find the simple interest,

$$\text{Simple interest} = I = \frac{P \times N \times R}{100}$$

$$= \frac{15000 \times 3 \times 10}{100}$$

$$= 4500$$

∴ Difference between the simple interest and compound interest = compound interest − simple interest

= 4965 – 4500

= 465

∴ The difference between the simple interest and compound interest is Rs. 465.

20. A certain amount doubles in 5 years under compound interest. In how many years will that amount become 8 times itself?

Solution :

Principal = P , Period = N = 5 years, Amount = A = 2P

Here, A = 8P then A = ?

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

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

Dividing both the side by P,

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

Taking cube on both the sides, we get,

$$(2)^3 = \left[\left(1 + \frac{R}{100}\right)^{5}\right]^{3}$$

$$8 = \left(1 + \frac{R}{100}\right)^{15}$$

$$\therefore N = 15$$

∴ The amount become 8 times itself in 15 years.

21. The annual charging table is given below. Find the amount and the compound interest from the following table.

Sr.No.	Principal (Rs.)	Rate (p.c.p.a.)	Duration(years)

1	8000	5	3
2	1250	10	2
3	16000	15	3
4	6400	$12\frac{1}{2}$	2

Solution :

(i) Here, P = Rs. 8000, R = 5 p.c.p.a. , N = 3 years

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

$$= 8000\left(1 + \frac{5}{100}\right)^3$$

$$= 8000\left(1 + \frac{1}{20}\right)^3$$

$$= 8000\left(\frac{21}{20}\right)^3$$

$$= 8000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20}$$

$$= 21 \times 21 \times 21$$

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

$$\therefore \text{Compound interest} = \text{Amount} - \text{Principal}$$

$= 9261 - 8000 = 1261$

$\therefore$ **Amount $=$ Rs. 9261 and Compound interest = Rs. 1261**

(ii) Here, P = Rs. 1250 , R = 10 p.c.p.a. , N = 2 years

$\therefore$ **Amount (A)** $= P\left(1 + \frac{R}{100}\right)^N$

$= 1250\left(1 + \frac{10}{100}\right)^2$

$= 1250\left(1 + \frac{1}{10}\right)^2$

$= 1250\left(\frac{11}{10}\right)^2$

$= 1250 \times \frac{11}{10} \times \frac{11}{10}$

$= \frac{25 \times 121}{2}$

$= \frac{3025}{2}$

$= 1512.50$

$\therefore$ **Compound interest = Amount $-$ Principal**

$= 1512.50 - 1250 = 262.50$

$\therefore$ **Amount $=$ Rs. 1512.50 and Compound interest = Rs. 262.50**

(iii) Here, P = Rs.16000 , R = 15 p.c.p.a. , N = 3 years

$\therefore$ **Amount (A)** $= P\left(1+\frac{R}{100}\right)^N$

$= 16000\left(1+\frac{15}{100}\right)^3$

$= 16000\left(1+\frac{3}{20}\right)^3$

$= 16000\left(\frac{23}{20}\right)^3$

$= 16000 \times \frac{23}{20} \times \frac{23}{20} \times \frac{23}{20}$

$= 2 \times 23 \times 23 \times 23$

Amount (A) = 24334

$\therefore$ **Compound interest = Amount – Principal**

= 24334 – 16000

= 8334

$\therefore$ **Amount** $= Rs.\,24,334$, **Compound interest = Rs. 8334**

(iv) Here, P = Rs. 6400, R = $12\frac{1}{2}$ **p.c.p.a. , N = 2 years**

$\therefore$ **Amount (A)** $= P\left(1+\frac{R}{100}\right)^N$

$$= 6400\left(1 + \frac{12.5}{100}\right)^2$$

$$= 6400\left(1 + \frac{125}{1000}\right)^2$$

$$= 6400\left(\frac{1125}{1000}\right)^2$$

$$= 6400\left(\frac{9}{8}\right)^2$$

$$= 6400 \times \frac{9}{8} \times \frac{9}{8}$$

$$= 100 \times 81$$

$$= 8100$$

∴ Compound interest = Amount – Principal

$$= 8100 - 6400$$

$$= 1700$$

∴ Amount = Rs. 8100 and Compound interest = Rs. 1700

22. The six month charging table is given below. Find the amount and the compound interest from the following table.

Sr.No.	Principal (Rs.)	Rate (p.c.p.a.)	Duration(years)
1	16000	10	$1\frac{1}{2}$
2	6400	15	1
3	4000	20	$1\frac{1}{2}$
4	2560	$12\frac{1}{2}$	1

Solution :

(i) Here, P = Rs. 16000 , R = 10 p.c.p.a.

$\therefore$ **Rate of six months** $= \frac{R}{2} = \frac{10}{2} = 5\%$, $N = 1\frac{1}{2} = \frac{3}{2}$ **years**

Duration for six months $= 2N = 2 \times \frac{3}{2} = 3$ **years**

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

$$= 16000\left(1 + \frac{5}{100}\right)^3$$

$$= 16000\left(1 + \frac{1}{20}\right)^3$$

$$= 16000\left(\frac{21}{20}\right)^3$$

$$= 16000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20}$$

$$= 2 \times 21 \times 21 \times 21$$

$$= 18522$$

∴ Compound interest = Amount – Principal

$$= 18522 - 16000 = 2522$$

∴ Amount = Rs. 18522 and = Rs. 2522

(ii) Here, Rate = 15 p.c.p.a.

∴ Rate for six months = $\frac{R}{2} = \frac{15}{2} = 7.5\%$, N = 1 year

∴ Duration for six months = $2N = 2 \times 1 = 2$ years

Here, $P = 6400$, $R = 7.5$, $N = 2$ years

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

$$= 6400\left(1 + \frac{7.5}{100}\right)^2$$

$$= 6400\left(1 + \frac{75}{1000}\right)^2$$

$$= 6400\left(\frac{1075}{1000}\right)^2$$

$$= 6400\left(\frac{43}{40}\right)^2$$

$$= 6400 \times \frac{43}{40} \times \frac{43}{40}$$

$$= 4 \times 43 \times 43$$

$$= 7396$$

∴ Compound interest = Amount – Principal

$$= 7396 - 6400 = 996$$

∴ Amount = Rs. 7396 and Compound interest = Rs.996

(iii) Here, (R) = 20 p.c.p.a.

∴ Rate for six months = $\frac{R}{2} = \frac{20}{2} = 10$ %,

N = $1\frac{1}{2}$ years = $\frac{3}{2}$ years

∴ Duration for six months = 2N = $2 \times \frac{3}{2}$ = 3 years

∴ Here, P = Rs. 4000, R = 10 %, N = 3 years

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

$$= 4000\left(1 + \frac{10}{100}\right)^3$$

$$= 4000\left(1 + \frac{1}{10}\right)^3$$

$$= 4000\left(\frac{11}{10}\right)^3$$

$$= 4000 \times \frac{11}{10} \times \frac{11}{10} \times \frac{11}{10}$$

$$= 4 \times 1331$$

$$= 5324$$

∴ Compound interest = Amount – Principal

$$= 5324 - 4000$$

$$= 1324$$

∴ Amount $= Rs.5324$ and Compound interest = Rs. 1324

(iv) Here, Rate (R) = $12\frac{1}{2}$ p. c. p. a. $= 12.5$

∴ Rate for six months = $\frac{R}{2} = \frac{12.5}{2} = 6.25\%$, N = 1 year

∴ Duration for six months = 2N = $2 \times 1 = 2$ years

∴ Here, P = Rs. 2560 , R = 6.25 %, N = 2 years

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

$$= 2560\left(1 + \frac{6.25}{100}\right)^2$$

$$= 2560\left(1 + \frac{625}{10000}\right)^2$$

$$= 2560\left(1 + \frac{1}{16}\right)^2$$

$= 2560 \left(\frac{17}{16}\right)^2$

$= 2560 \times \frac{17}{16} \times \frac{17}{16}$

$= 10 \times 17 \times 17$

$= 2890$

∴ Compound interest = Amount – Principal

$= 2890 - 2560$

$= 330$

∴ Amount = Rs. 2890 and Compound interest = Rs. 330

23. Complete the following table:

Sr. No.	Principal (Rs.)	Rate (p.c.p.a.)	Duration (years)	Amount (Rs.)	Compound Interest (Rs.)
1	12800	5	2	--------	--------
2	10000	--------	3	13310	--------
3	2400	15	--------	3174	--------
4	--------	$12\frac{1}{2}$	3	7290	--------

Solution :

(i) Here, P = Rs.12800 , Rate (R) = 5 , N = 2 years

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

$$= 12800\left(1 + \frac{5}{100}\right)^2$$

$$= 12800\left(1 + \frac{1}{20}\right)^2$$

$$= 12800\left(\frac{21}{20}\right)^2$$

$$= 12800 \times \frac{21}{20} \times \frac{21}{20}$$

$$= 32 \times 21 \times 21$$

$$= 14112$$

∴ Compound interest = Amount – Principal

$$= 14112 - 12800 = 1312$$

∴ Amount = Rs. 14112 and Compound interest = Rs. 1312

(ii) Here, P = Rs. 10000 , Rate (R) = ? , N = 3 years,

Amount (A) = Rs. 13310

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

$$13310 = 10000\left(1 + \frac{R}{100}\right)^3$$

$\therefore 13310 = 10000\left(\frac{100+R}{100}\right)^3$

$\therefore 13310 = 10000 \times \frac{(100+R)^3}{1000000}$

$\therefore 13310 = \frac{(100+R)^3}{100}$

$\therefore 13310 \times 100 = (100 + R)^3$

$\therefore 1331000 = (100 + R)^3$

$\therefore 1331 \times 1000 = (100 + R)^3$

$(11)^3 \times (10)^3 = (100 + R)^3$

Taking cube root on both sides,

$11 \times 10 = 100 + R$

$110 = 100 + R$

$R = 110 - 100 = 10$

∴ **Compound interest = Amount – Principal**

$= 13310 - 10000$

$= 3310$

∴ **Rate = 10 p.c.p.a. and Compound interest = Rs. 3310**

(iii) Here, P = 2400, Rate (R) = 15, Amount (A) = Rs. 3174

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

$$3174 = 2400\left(1 + \frac{15}{100}\right)^N$$

$$= 2400\left(1 + \frac{3}{20}\right)^N$$

$$\therefore 3174 = 2400\left(\frac{23}{20}\right)^N$$

$$\therefore \frac{3174}{2400} = \left(\frac{23}{20}\right)^N$$

$$\therefore \frac{529 \times 6}{400 \times 6} = \left(\frac{23}{20}\right)^N$$

$$\therefore \frac{529}{400} = \left(\frac{23}{20}\right)^N$$

$$\therefore \left(\frac{23}{20}\right)^2 = \left(\frac{23}{20}\right)^N$$

$$\therefore \underline{N = 2}$$

∴ Compound interest = Amount – Principal

= 3174 – 2400

= 774

∴ Duration = 2 years and Compound interest = Rs. 774

(iv) Here, Amount (A) = Rs.7290 , Rate (R) = $12\frac{1}{2} = 12.5\%$,

Duration (N) = 3 years

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

$\therefore 7290 = P\left(1 + \frac{12.5}{100}\right)^3$

$\therefore 7290 = P\left(1 + \frac{125}{1000}\right)^3$

$\therefore 7290 = P\left(1 + \frac{1125}{1000}\right)^3$

$\therefore 7290 = P\left(\frac{9}{8}\right)^3$

$P = 7290 \times \left(\frac{8}{9}\right)^3$

$P = 7290 \times \frac{8}{9} \times \frac{8}{9} \times \frac{8}{9}$

$P = 10 \times 8 \times 8 \times 8$

$P = 5120$

$\therefore$ Compound interest = Amount – Principal

= 7290 – 5120

= 2170

$\therefore$ Principal (P) = Rs. 5120 and Compound interest = Rs. 2170

Table :

Sr. No.	Principal (Rs.)	Rate (p.c.p.a.)	Duration (years)	Amount (Rs.)	Compound Interest (Rs.)
1	12800	5	2	14112	1312
2	10000	10	3	13310	3310
3	2400	15	2	3174	774
4	5120	$12\frac{1}{2}$	3	7290	2170

24. State whether the following statements are true and false.

1. The amount taken by a bank or Patapedhi is called interest.

Ans.: False, The amount taken by a bank or Patapedhi is called principal.

2. The time for which the principal is used is called the period.

Ans.: True

3. The value of the article decreases, then the rate of depreciation R is taken as positive.

Ans.: False, The value of the article decreases, then the rate of depreciation R is taken as negative.

4. If the value of the article increases, then the rate of depreciation R is taken as positive.

Ans.: True

5. Now a days banks calculated compound interest monthly.

Ans.: False, Now a days banks calculated compound interest daily.

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