Compound Interest
Ex 11A

1. Let Principal = P, Rate = R% per annum, Time = n years.

2. **When interest is compound Annually:**

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

3. **When interest is compounded Half-yearly:**

$$\text{Amount} = P\left[1 + \frac{(R/2)}{100}\right]^{2n}$$

4. **When interest is compounded Quarterly:**

$$\text{Amount} = P\left[1 + \frac{(R/4)}{100}\right]^{4n}$$

5. **When interest is compounded Annually but time is in fraction, say $3\frac{2}{5}$ years.**

$$\text{Amount} = P\left(1 + \frac{R}{100}\right)^3 \times \left(1 + \frac{\frac{2}{5}R}{100}\right)$$

6. **When Rates are different for different years, say R_1%, R_2%, R_3% for 1st, 2nd and 3rd year respectively.**

$$\text{Then, Amount} = P\left(1 + \frac{R_1}{100}\right)\left(1 + \frac{R_2}{100}\right)\left(1 + \frac{R_3}{100}\right).$$

7. **Present worth of Rs. x due n years hence is given by:**

$$\text{Present Worth} = \frac{x}{\left(1 + \frac{R}{100}\right)}.$$

Future Value Formula (compound interest)

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

Where:

A = resulting amount (future value)
P = amount of principal (present value)
r = annual interest rate
n = number of compounding periods per year
t = time (in years)

Let Principal = P, Rate = R% per annum, Time = n years.

1. When interest is compounded annually :

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

2. When interest is compounded half-yearly :

$$\text{Amount} = P\left[1 + \frac{(R/2)}{100}\right]^{2n}$$

3. When interest is compounded quarterly :

$$\text{Amount} = P\left[1 + \frac{(R/4)}{100}\right]^{4n}$$

4. When interest is compounded annually but time is in fraction, say $3\frac{2}{5}$ years.

$$\text{Amount} = P\left(1 + \frac{R}{100}\right)^3 \times \left(1 + \frac{\frac{2}{5}R}{100}\right)$$

5. When rates are different for different years, say R_1% , R_2%, R_3% for 1st, 2nd and 3rd year respectively. Then,

$$\text{Amount} = P\left(1 + \frac{R_1}{100}\right)\left(1 + \frac{R_2}{100}\right)\left(1 + \frac{R_3}{100}\right)$$

6. **Growth :** If the rate of growth is constant, then

$$V = V_0\left(1 + \frac{r}{100}\right)^n$$

where $r\%$ is the rate of growth per year, n is the number of years, V_0 is the present measure of the quantity and V is the measure of the quantity after n years.

Similarly, if V_0 is the measure of the quantity n years ago and V is the present measure of the quantity, then

$$V = V_0\left(1 + \frac{r}{100}\right)^n$$

7. **Depreciation :** If the rate of depreciation is constant, then

$$V = V_0\left(1 - \frac{r}{100}\right)^n$$

where $r\%$ is the rate of depreciation per year, n is the number of years, V_0 is the present value and V is the value after n years.

Q1.
Answer :

Principal for the first year = Rs. 2500

Interest for the first year = Rs. $\left(\frac{2500 \times 10 \times 1}{100}\right)$ = Rs. 250

Amount at the end of the first year = Rs. $\left(2500 + 250\right)$ = Rs. 2750

Principal for the second year = Rs. 2750

Interest for the second year = Rs. $\left(\frac{2750 \times 10 \times 1}{100}\right)$ = Rs. 275

Amount at the end of the second year = Rs. $\left(2750 + 275\right)$ = Rs. 3025

∴ Compound interest = Rs. $(3025 - 2500)$ = Rs. 525

Q2.

Answer :

Principal for the first year $=$ Rs. 15625

Interest for the first year $=$ Rs. $\left(\frac{15625 \times 12 \times 1}{100}\right)=$ Rs. 1875

Amount at the end of the first year $=$ Rs. $\left(15625+1875\right)=$ Rs. 17500

Principal for the second year $=$ Rs. 17500

Interest for the second year $=$ Rs. $\left(\frac{17500 \times 12 \times 1}{100}\right)=$ Rs. 2100

Amount at the end of the second year $=$ Rs. $\left(17500+2100\right)=$ Rs. 19600

Principal for the third year $=$ Rs. 19600

Interest for the third year $=$ Rs. $\left(\frac{19600 \times 12 \times 1}{100}\right)=$ Rs. 2352

Amount at the end of the second year $=$ Rs $\left(19600+2352\right)=$ Rs. 21952

$\therefore$ Compound interest $=$ Rs. $(21952-15625)=$ Rs. 6327

Q3.

Answer :

Principal amount $=$ Rs. 5000

Simple interest $=$ Rs. $\left(\frac{5000 \times 2 \times 9}{100}\right)=$ Rs. 900

The compound interest can be calculated as follows :

Principal for the first year $=$ Rs. 5000

Interest for the first year $=$ Rs. $\left(\frac{5000 \times 9 \times 1}{100}\right)=$ Rs. 450

Amount at the end of the first year $=$ Rs. $\left(5000+450\right)=$ Rs. 5450

Principal for the second year $=$ Rs. 5450

Interest for the second year $=$ Rs. $\left(\frac{5450 \times 9 \times 1}{100}\right)=$ Rs. 490.5

Amount at the end of the second year $=$ Rs. $\left(5450+490.5\right)=$ Rs. 5940.5

$\therefore$ Compound interest $=$ Rs. $(5940.5-5000)=$ Rs. 940.5

Now, difference between the simple interest and the compound interest $=(CI-SI)=$ Rs. $(940.5-900)=$ Rs. 40.5

Q4.

Answer :

Principal for the first year $=$ Rs. 25000

Interest for the first year $=$ Rs. $\left(\frac{25000 \times 8 \times 1}{100}\right)=$ Rs. 2000

Amount at the end of the first year $=$ Rs. $\left(25000+2000\right)=$ Rs. 27000

Principal for the second year $=$ Rs. 27000

Interest for the second year $=$ Rs. $\left(\frac{27000 \times 8 \times 1}{100}\right)=$ Rs. 2160

Amount at the end of the second year $=$ Rs. $\left(27000+2160\right)=$ Rs. 29160

Therefore, Ratna has to pay Rs. 29160 after 2 years to discharge her debt.

Q5.

Answer :

Principal amount = Rs. 20000

Simple interest = Rs. $\left(\frac{20000 \times 2 \times 12}{100}\right)$ = Rs. 4800

The compound interest can be calculated as follows :

Principal for the first year = Rs. 20000

Interest for the first year = Rs. $\left(\frac{20000 \times 12 \times 1}{100}\right)$ = Rs. 2400

Now, amount at the end of the first year = Rs. $\left(20000 + 2400\right)$ = Rs. 22400

Principal for the second year = Rs. 22400

Interest for the second year = Rs. $\left(\frac{22400 \times 12 \times 1}{100}\right)$ = Rs. 2688

Now, amount at the end of the second year = Rs. $\left(22400 + 2688\right)$ = Rs. 25088

Hence, compound interest = Rs. (25088 − 20000) = Rs. 5088

Now, CI − SI = Rs. (5088 − 4800) = Rs. 288

∴ The amount of money Harpreet will gain after two years is Rs 288.

Q6.

Answer :

Principal for the first year = Rs. 64000

Interest for the first year = Rs. $\left(\frac{64000 \times 15 \times 1}{100 \times 2}\right)$ = Rs. 4800

Now, amount at the end of the first year = Rs. $\left(64000 + 4800\right)$ = Rs. 68800

Principal for the second year = Rs. 68800

Interest for the second year = Rs. $\left(\frac{68800 \times 15 \times 1}{100 \times 2}\right)$ = Rs. 5160

Now, amount at the end of the second year = Rs. $\left(68800 + 5160\right)$ = Rs. 73960

Principal for the third year = Rs. 73960

Interest for the third year = Rs. $\left(\frac{73960 \times 15 \times 1}{100 \times 2}\right)$ = Rs. 5547

Now, amount at the end of the third year = Rs. $\left(73960 + 5547\right)$ = Rs. 79507

∴ Manoj will get an amount of Rs. 79507 after 3 years.

Q7.

Answer :

Principal amount = Rs. 6250

Rate of interest = 8% per annum = 4% for half year

Time = 1 year = 2 half years

Principal for the first half year = Rs. 6250

Interest for the first half year = Rs. $\left(\frac{6250 \times 4 \times 1}{100}\right)$ = Rs. 250

Now, amount at the end of the first half year = Rs. $\left(6250 + 250\right)$ = Rs. 6500

Principal for the second half year = Rs. 6500

Interest for the second half year = Rs. $\left(\frac{6500 \times 4 \times 1}{100}\right)$ = Rs. 260

Now, amount at the end of the second half year = Rs $\left(6500 + 260\right)$ = Rs. 6760

∴ Compound interest = Rs (6760 − 6250) = Rs 510

Hence, Divakaran gets a compound interest of Rs 510.

Q8.

Answer :

Principal amount = Rs. 16000

Rate of interest = 10% per annum = 5% for half year

Time = $1\frac{1}{2}$ years = 3 half years

Principal for the first half year = Rs. 16000

Interest for the first half year = Rs. $\left(\frac{16000 \times 5 \times 1}{100}\right)$ = Rs. 800

Now, amount at the end of the first half year = Rs. $\left(16000 + 800\right)$ = Rs. 16800

Principal for the second half year = Rs. 16800

Interest for the second half year = Rs. $\left(\frac{16800 \times 5 \times 1}{100}\right)$ = Rs. 840

Now, amount at the end of the second half year = Rs. $\left(16800 + 840\right)$ = Rs. 17640

Principal for the third half year = Rs. 17640

Interest for the third half year = Rs. $\left(\frac{17640 \times 5 \times 1}{100}\right)$ = Rs. 882

Now, amount at the end of the third half year = Rs. $\left(17640 + 882\right)$ = Rs. 18522

∴ The amount of money Michael has to pay the finance company after $1\frac{1}{2}$ years is Rs 18522.