

# 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 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> 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:

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

### **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.  $(2500 + 250)$  = 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.  $(2750 + 275)$  = Rs. 3025

$\therefore$  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.  $(15625 + 1875)$  = 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.  $(17500 + 2100)$  = 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.  $(19600 + 2352)$  = 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.  $(5000 + 450)$  = 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.  $(5450 + 490.5)$  = 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.  $(25000 + 2000)$  = 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.  $(27000 + 2160)$  = 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.  $(20000 + 2400)$  = 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.  $(22400 + 2688)$  = 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.  $(64000 + 4800)$  = 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.  $(68800 + 5160)$  = 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.  $(73960 + 5547)$  = 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.  $(6250 + 250)$  = 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.  $(6500 + 260)$  = 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.  $(16000 + 800)$  = 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.  $(16800 + 840)$  = 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.  $(17640 + 882)$  = Rs. 18522

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

# Compound Interest

## Ex 11B

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 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> 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:

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

### **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)**

Q1.

**Answer :**

Principal amount,  $P = \text{Rs } 6000$

Rate of interest,  $R = 9\%$  per annum

Time,  $n = 2$  years.

The formula for the amount including the compound interest is given below :

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

$$\Rightarrow A = \text{Rs. } 6000 \left( 1 + \frac{9}{100} \right)^2$$

$$\Rightarrow A = \text{Rs. } 6000 \left( \frac{100+9}{100} \right)^2$$

$$\Rightarrow A = \text{Rs. } 6000 \left( \frac{109}{100} \right)^2$$

$$\Rightarrow A = \text{Rs. } 6000 (1.09 \times 1.09)^2$$

$$\Rightarrow A = \text{Rs. } 7128.6$$

i.e., the amount including the compound interest is Rs 7128.6.

$\therefore$  Compound interest = Rs  $(7128.6 - 6000) = \text{Rs } 1128.6$

Q2.

Answer :

Principal amount,  $P = \text{Rs. } 10000$

Rate of interest,  $R = 11\%$  per annum.

Time,  $n = 2$  years.

The formula for the amount including the compound interest is given below :

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

$$\Rightarrow A = \text{Rs. } 10000 \left(1 + \frac{11}{100}\right)^2$$

$$\Rightarrow A = \text{Rs. } 10000 \left(\frac{100+11}{100}\right)^2$$

$$\Rightarrow A = \text{Rs. } 10000 \left(\frac{111}{100}\right)^2$$

$$\Rightarrow A = \text{Rs. } 10000 (1.11 \times 1.11)^2$$

$$\Rightarrow A = \text{Rs. } 12321$$

i.e., the amount including the compound interest is Rs 12321.

$\therefore$  Compound interest = Rs.  $(12321 - 10000) = \text{Rs. } 2321$

Q3.

Answer :

Principal amount,  $P = \text{Rs. } 31250$

Rate of interest,  $R = 8\%$  per annum.

Time,  $n = 3$  years.

The formula for the amount including the compound interest is given below :

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

$$\Rightarrow A = \text{Rs. } 31250 \left(1 + \frac{8}{100}\right)^3$$

$$\Rightarrow A = \text{Rs. } 31250 \left(\frac{100+8}{100}\right)^3$$

$$\Rightarrow A = \text{Rs. } 31250 \left(\frac{108}{100}\right)^3$$

$$\Rightarrow A = \text{Rs. } 31250 (1.08 \times 1.08 \times 1.08)^3$$

$$\Rightarrow A = \text{Rs. } 39366$$

i.e., the amount including the compound interest is Rs 39366.

$\therefore$  Compound interest = Rs.  $(39366 - 31250) = \text{Rs. } 8116$

Q4.

Answer :

Principal amount,  $P = \text{Rs. } 10240$

Rate of interest,  $R = 12\frac{1}{2}\%$  p.a.

Time,  $n = 3$  years

The formula for the amount including the compound interest is given below :

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

$$\Rightarrow A = \text{Rs. } 10240 \left(1 + \frac{25}{100 \times 2}\right)^3$$

$$\Rightarrow A = \text{Rs. } 10240 \left(1 + \frac{25}{200}\right)^3$$

$$\Rightarrow A = \text{Rs. } 10240 \left(1 + \frac{1}{8}\right)^3$$

$$\Rightarrow A = \text{Rs. } 10240 \left(\frac{8+1}{8}\right)^3$$

$$\Rightarrow A = \text{Rs. } 10240 \left(\frac{9}{8}\right)^3$$

$$\Rightarrow A = \text{Rs. } 10240 (1.125 \times 1.125 \times 1.125)^3$$

$$\Rightarrow A = \text{Rs. } 14580$$

i.e., the amount including the compound interest is Rs 14580.

$\therefore$  Compound interest = Rs  $(14580 - 10240) = \text{Rs. } 4340$

Q5.

Answer :

Principal amount,  $P = \text{Rs } 62500$

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

Time,  $n = 2 \text{ years } 6 \text{ months} = \frac{5}{2} = 2 \frac{1}{2} \text{ years}$

The formula for the amount including the compound interest is given below :

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

$$\Rightarrow A = \text{Rs. } 62500 \left(1 + \frac{12}{100}\right)^2 \times \left(1 + \frac{\frac{1}{2} \times 12}{100}\right)$$

$$\Rightarrow A = \text{Rs. } 62500 \left(1 + \frac{12}{100}\right)^2 \times \left(1 + \frac{6}{100}\right)$$

$$\Rightarrow A = \text{Rs. } 62500 \times 1.12 \times 1.12 \times 1.06$$

$$\Rightarrow A = \text{Rs. } 83104$$

i.e., the amount including the compound interest is Rs 83104.

$$\therefore \text{Compound interest} = \text{Rs. } (83104 - 62500) = \text{Rs. } 20604$$

Q6

Answer :

Principal amount,  $P = \text{Rs. } 9000$

Rate of interest,  $R = 10\% \text{ p.a.}$

Time,  $n = 2 \text{ years } 4 \text{ months} = 2 \frac{1}{3} \text{ years} = \frac{7}{3} \text{ years}$

The formula for the amount including the compound interest is given below :

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

$$= \text{Rs. } \left(9000 \times \left(1 + \frac{10}{100}\right)^2 \times \left(1 + \frac{\frac{1}{3} \times 10}{100}\right)\right)$$

$$= \text{Rs. } (9000 \times 1.10 \times 1.10 \times 1.033)$$

$$= \text{Rs. } 11252.9 \approx 11253$$

i.e., the amount including the compound interest is Rs 11253.

$$\therefore \text{Compound interest} = \text{Rs. } (11253 - 9000) = \text{Rs. } 2253$$

Q7.

Answer :

Principal amount,  $P = \text{Rs. } 8000$

Rate of interest for the first year,  $p = 9\% \text{ p.a.}$

Rate of interest for the second year,  $q = 10\% \text{ p.a.}$

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

Formula for the amount including the compound interest for the first year :

$$A = \text{Rs. } \left\{P \times \left(1 + \frac{p}{100}\right) \times \left(1 + \frac{q}{100}\right)\right\}$$

$$= \text{Rs. } \left\{8000 \times \left(1 + \frac{9}{100}\right) \times \left(1 + \frac{10}{100}\right)\right\}$$

$$= \text{Rs. } \left\{8000 \times \left(\frac{109}{100}\right) \times \left(\frac{110}{100}\right)\right\}$$

$$= \text{Rs. } \{8000 \times (1.09) \times (1.1)\}$$

$$= \text{Rs. } 9592$$

i.e., the amount including the compound interest for first year is Rs 9592.

Q8.

Answer :

Principal amount,  $P = \text{Rs. } 125000$

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

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

The amount including the compound interest is calculated using the formula,

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

$$= \text{Rs. } 125000 \left(1 + \frac{8}{100}\right)^3$$

$$= \text{Rs. } 125000 \left(\frac{108}{100}\right)^3$$

$$= \text{Rs. } 125000 \left(\frac{108}{100}\right)^3$$

$$= \text{Rs. } 125000 (1.08)^3$$

$$= \text{Rs. } 125000 (1.08 \times 1.08 \times 1.08)$$

$$= \text{Rs. } 157464$$

$\therefore$  Anand has to pay Rs 157464 after 3 years to clear the debt.

Q9.



Answer :

Principal amount,  $P = \text{Rs. } 11000$

Rate of interest,  $R = 10\% \text{ p. a.}$

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

The amount including the compound interest is calculated using the formula,

$$\begin{aligned} A &= \text{Rs. } P \left(1 + \frac{R}{100}\right)^n \\ &= \text{Rs. } 11000 \left(1 + \frac{10}{100}\right)^3 \\ &= \text{Rs. } 11000 \left(\frac{100+10}{100}\right)^3 \\ &= \text{Rs. } 11000 \left(\frac{110}{100}\right)^3 \\ &= \text{Rs. } 11000 (1.1)^3 \\ &= \text{Rs. } 11000 (1.1 \times 1.1 \times 1.1) \\ &= \text{Rs. } 14641 \end{aligned}$$

Therefore, Beeru has to pay Rs 14641 to clear the debt.

Q10.

Answer :

Principal amount,  $P = \text{Rs. } 18000$

Rate of interest for the first year,  $p = 12\% \text{ p. a.}$

Rate of interest for the second year,  $q = 12\frac{1}{2}\% \text{ p. a.}$

Time,  $n = 2 \text{ years}$

The formula for the amount including the compound interest for the first year is given below :

$$\begin{aligned} A &= \left\{ P \times \left(1 + \frac{p}{100}\right) \times \left(1 + \frac{q}{100}\right) \right\} \\ &= \text{Rs. } \left\{ 18000 \times \left(1 + \frac{12}{100}\right) \times \left(1 + \frac{25}{100 \times 2}\right) \right\} \\ &= \text{Rs. } \left\{ 18000 \times \left(\frac{100+12}{100}\right) \times \left(1 + \frac{25}{200}\right) \right\} \\ &= \text{Rs. } \left\{ 18000 \times \left(\frac{100+12}{100}\right) \times \left(1 + \frac{1}{8}\right) \right\} \\ &= \text{Rs. } \left\{ 18000 \times \left(\frac{100+12}{100}\right) \times \left(\frac{8+1}{8}\right) \right\} \\ &= \text{Rs. } \left\{ 18000 \times \left(\frac{112}{100}\right) \times \left(\frac{9}{8}\right) \right\} \\ &= \text{Rs. } \{18000 \times (1.12) \times (1.125)\} \\ &= \text{Rs. } 22680 \end{aligned}$$

$\therefore$  Shubhalaxmi has to pay Rs 22680 to the finance company after 2 years.

Q11.

Answer :

Principal amount,  $P = \text{Rs. } 24000$

Rate of interest,  $R = 10\% \text{ p. a.}$

Time,  $n = 2 \text{ years } 3 \text{ months} = 2\frac{1}{4} \text{ years}$

The formula for the amount including the compound interest is given below :

$$\begin{aligned} A &= P \times \left(1 + \frac{R}{100}\right)^n \times \left(1 + \frac{\frac{1}{4}R}{100}\right) \\ &= \text{Rs. } 24000 \times \left(1 + \frac{10}{100}\right)^2 \times \left(1 + \frac{\frac{1}{4} \times 10}{100}\right) \\ &= \text{Rs. } 24000 \times \left(\frac{100+10}{100}\right)^2 \times \left(\frac{100+2.5}{100}\right) \\ &= \text{Rs. } 24000 \times \left(\frac{110}{100}\right)^2 \times \left(\frac{100+2.5}{100}\right) \\ &= \text{Rs. } 24000 \times (1.1 \times 1.1 \times 1.025) \\ &= \text{Rs. } 24000 \times (1.250) \\ &= \text{Rs. } 29766 \end{aligned}$$

Therefore, Neha should pay Rs 29766 to the bank after 2 years 3 months.

Q12.

Answer :

Principal amount,  $P = \text{Rs } 16000$

Rate of interest,  $R = \frac{15}{2} \% \text{ p.a.}$

Time,  $n = 2 \text{ years}$

Now, simple interest  $= \text{Rs } \left( \frac{16000 \times 2 \times 15}{100 \times 2} \right) = \text{Rs. } 2400$

Amount including the simple interest  $= \text{Rs } (16000 + 2400) = \text{Rs } 18400$

The formula for the amount including the compound interest is given below :

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

$$= \text{Rs. } 16000 \left( 1 + \frac{15}{100 \times 2} \right)^2$$

$$= \text{Rs. } 16000 \left( 1 + \frac{15}{200} \right)^2$$

$$= \text{Rs. } 16000 \left( 1 + \frac{3}{40} \right)^2$$

$$= \text{Rs. } 16000 \left( \frac{40+3}{40} \right)^2$$

$$= \text{Rs. } 16000 \left( \frac{43}{40} \right)^2$$

$$= \text{Rs. } 16000 (1.075 \times 1.075)$$

i.e., the amount including the compound interest is Rs 18490.

Now,  $(\text{CI} - \text{SI}) = \text{Rs. } (18490 - 18400) = \text{Rs. } 90$

Therefore, Abhay gains Rs. 90 as profit at the end of 2 years.

Q13.

Answer :

Simple interest  $(\text{SI}) = \text{Rs. } 2400$

Rate of interest,  $R = 8\%$

Time,  $n = 2 \text{ years}$

The principal can be calculated using the formula :

$$\text{Sum} = \left( \frac{100 \times \text{SI}}{R \times T} \right)$$

$$\Rightarrow \text{Sum} = \text{Rs. } \left( \frac{100 \times 2400}{8 \times 2} \right) = \text{Rs. } 15000$$

i.e., the principal is Rs. 15000.

The amount including the compound interest is calculated using the formula given below :

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

$$= \text{Rs. } 15000 \left( 1 + \frac{8}{100} \right)^2$$

$$= \text{Rs. } 15000 \left( \frac{100+8}{100} \right)^2$$

$$= \text{Rs. } 15000 \left( \frac{108}{100} \right)^2$$

$$= \text{Rs. } 15000 (1.08 \times 1.08)$$

$$= \text{Rs. } 17496$$

i.e., the amount including the compound interest is Rs. 17496.

$\therefore$  Compound interest  $(\text{CI}) = \text{Rs. } (17496 - 15000) = \text{Rs. } 2496$

Q14.

Answer :

Let Rs  $P$  be the sum.

Then  $\text{SI} = \left( \frac{P \times 2 \times 6}{100} \right) = \text{Rs. } \frac{12P}{100} = \text{Rs. } \frac{3P}{25}$

Also,  $\text{CI} = \left\{ P \times \left( 1 + \frac{6}{100} \right)^2 - P \right\}$

$$= \text{Rs. } \left\{ P \times \left( \frac{100+6}{100} \right)^2 - P \right\}$$

$$= \text{Rs. } \left\{ P \times \left( \frac{53}{50} \right)^2 - P \right\}$$

$$= \text{Rs. } \left\{ \left( \frac{2809P}{2500} \right) - P \right\}$$

$$= \text{Rs. } \left\{ \frac{2809P - 2500P}{2500} \right\} = \text{Rs. } \frac{309P}{2500}$$

Now,  $(\text{CI} - \text{SI}) = \text{Rs. } \left( \frac{309P}{2500} - \frac{3P}{25} \right)$

$$= \text{Rs. } \left( \frac{309P - 300P}{2500} \right)$$

$$= \text{Rs. } \frac{9P}{2500}$$

Now,  $\text{Rs. } 90 = \frac{9P}{2500}$

$$\Rightarrow P = \left( \frac{90 \times 2500}{9} \right) = \text{Rs. } 25000$$

Hence, the required sum is Rs. 25000.

Q15.

Answer :

Let  $P$  be the sum.

$$\text{Then SI} = \text{Rs} \left( \frac{P \times 3 \times 10}{100} \right) = \text{Rs} \frac{30P}{100} = \text{Rs} \frac{3P}{10}$$

$$\text{Also, CI} = \text{Rs.} \left\{ P \times \left( 1 + \frac{10}{100} \right)^3 - P \right\}$$

$$= \text{Rs.} \left\{ P \times \left( \frac{100+10}{100} \right)^3 - P \right\}$$

$$= \text{Rs.} \left\{ P \times \left( \frac{11}{10} \right)^3 - P \right\}$$

$$= \text{Rs.} \left\{ \left( \frac{1331P}{1000} \right) - P \right\}$$

$$= \text{Rs.} \left\{ \frac{1331P - 1000P}{1000} \right\}$$

$$= \text{Rs.} \frac{331P}{1000}$$

$$\text{Now, (CI - SI)} = \text{Rs} \left( \frac{331P}{1000} - \frac{3P}{10} \right)$$

$$= \text{Rs} \left( \frac{331P - 300P}{1000} \right)$$

$$= \text{Rs} \frac{31P}{1000}$$

$$\text{Now, Rs. 93} = \frac{31P}{1000}$$

$$\Rightarrow P = \left( \frac{93 \times 1000}{31} \right) = \text{Rs. 3000}$$

Hence, the *required* sum is Rs. 3000.

Q16.

Answer :

Let  $P$  be the sum.

$$\text{Rate of interest, } R = 6\frac{2}{3}\% = \frac{20}{3}\%$$

Time,  $n = 2$  years

$$\text{Now, } A = P \times \left( 1 + \frac{20}{100 \times 3} \right)^2$$

$$= \text{Rs. } P \times \left( 1 + \frac{20}{300} \right)^2$$

$$= \text{Rs. } P \times \left( \frac{300+20}{300} \right)^2$$

$$= \text{Rs. } P \times \left( \frac{320}{300} \right)^2$$

$$= \text{Rs. } P \times \left( \frac{16}{15} \times \frac{16}{15} \right)$$

$$= \text{Rs. } \frac{256P}{225}$$

$$\Rightarrow \text{Rs. 10240} = \text{Rs. } \frac{256P}{225}$$

$$\Rightarrow \text{Rs.} \left( \frac{10240 \times 225}{256} \right) = P$$

$$\therefore P = \text{Rs. 9000}$$

Hence, the *required* sum is Rs. 9000

Q17.

Answer :

Let  $P$  be the sum.

Rate of interest,  $R = 10\%$

Time,  $n = 3$  years

$$\text{Now, } A = P \times \left( 1 + \frac{10}{100} \right)^3$$

$$= \text{Rs. } P \times \left( \frac{100+10}{100} \right)^3$$

$$= \text{Rs. } P \times \left( \frac{110}{100} \right)^3$$

$$= \text{Rs. } P \times \left( \frac{11}{10} \times \frac{11}{10} \times \frac{11}{10} \right)$$

$$= \text{Rs. } \frac{1331P}{1000}$$

However, amount = Rs. 21296

$$\text{Now, Rs. 21296} = \text{Rs. } \frac{1331P}{1000}$$

$$\Rightarrow \text{Rs.} \left( \frac{21296 \times 1000}{1331} \right) = P$$

$$\therefore P = \text{Rs. 16000}$$

Hence, the *required* sum is Rs. 16000.

Q18.

**Answer :**

Let  $R\%$  p.a. be the required rate.

$$A = 4410$$

$$P = 4000$$

$$n = 2 \text{ years}$$

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

$$\Rightarrow 4410 = 4000 \left(1 + \frac{R}{100}\right)^2$$

$$\Rightarrow \frac{4410}{4000} = \left(1 + \frac{R}{100}\right)^2$$

$$\Rightarrow \frac{441}{400} = \left(1 + \frac{R}{100}\right)^2$$

$$\Rightarrow \left(\frac{21}{20}\right)^2 = \left(1 + \frac{R}{100}\right)^2$$

$$\Rightarrow \frac{21}{20} - 1 = \frac{R}{100}$$

$$\Rightarrow \frac{21-20}{20} = \frac{R}{100}$$

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

$$\Rightarrow R = \left(\frac{1 \times 100}{20}\right) = 5$$

Hence, the required rate is 5% p.a.

Q19.

**Answer :**

Let the required rate be  $R\%$  p.a.

$$A = 774.40$$

$$P = 640$$

$$n = 2 \text{ years}$$

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

$$\Rightarrow 774.40 = 640 \left(1 + \frac{R}{100}\right)^2$$

$$\Rightarrow \frac{774.40}{640} = \left(1 + \frac{R}{100}\right)^2$$

$$\Rightarrow 1.21 = \left(1 + \frac{R}{100}\right)^2$$

$$\Rightarrow (1.1)^2 = \left(1 + \frac{R}{100}\right)^2$$

$$\Rightarrow 1.1 - 1 = \frac{R}{100}$$

$$\Rightarrow 0.1 = \frac{R}{100}$$

$$\Rightarrow R = (0.1 \times 100) = 10$$

Hence, the required rate is 10% p.a.

Q20.

**Answer :**

Let the required time be  $n$  years.

Rate of interest,  $R = 10\%$

Principal amount,  $P = \text{Rs. } 1800$

Amount with compound interest,  $A = \text{Rs. } 2178$

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

$$= \text{Rs. } 1800 \times \left(1 + \frac{10}{100}\right)^n$$

$$= \text{Rs. } 1800 \times \left(\frac{100+10}{100}\right)^n$$

$$= \text{Rs. } 1800 \times \left(\frac{110}{100}\right)^n$$

$$= \text{Rs. } 1800 \times \left(\frac{11}{10}\right)^n$$

However, amount = Rs. 2178

$$\text{Now, Rs. } 2178 = \text{Rs. } 1800 \times \left(\frac{11}{10}\right)^n$$

$$\Rightarrow \frac{2178}{1800} = \left(\frac{11}{10}\right)^n$$

$$\Rightarrow \frac{121}{100} = \left(\frac{11}{10}\right)^n$$

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

$$\Rightarrow n = 2$$

$\therefore$  Time,  $n = 2$  years

Q21.

**Answer :**

Let the required time be  $n$  years.

Rate of interest,  $R = 8\%$

Principal amount,  $P = \text{Rs. } 6250$

Amount with compound interest,  $A = \text{Rs. } 7290$

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

$$\Rightarrow A = \text{Rs. } 6250 \times \left(1 + \frac{8}{100}\right)^n$$

$$= \text{Rs. } 6250 \times \left(\frac{100+8}{100}\right)^n$$

$$= \text{Rs. } 6250 \times \left(\frac{108}{100}\right)^n$$

$$= \text{Rs. } 6250 \times \left(\frac{27}{25}\right)^n$$

However, amount = Rs. 7290

$$\text{Now, Rs. } 7290 = \text{Rs. } 6250 \times \left(\frac{27}{25}\right)^n$$

$$\Rightarrow \frac{7290}{6250} = \left(\frac{27}{25}\right)^n$$

$$\Rightarrow \frac{729}{625} = \left(\frac{27}{25}\right)^n$$

$$\Rightarrow \left(\frac{27}{25}\right)^2 = \left(\frac{27}{25}\right)^n$$

$$\Rightarrow n = 2$$

$\therefore$  Time,  $n = 2$  years

Q22.

**Answer :**

Population of the town,  $P = 125000$

Rate of increase,  $R = 2\%$

Time,  $n = 3$  years

Then the population of the town after 3 years is given by

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

$$= 125000 \times \left(1 + \frac{2}{100}\right)^3$$

$$= 125000 \times \left(\frac{100+2}{100}\right)^3$$

$$= 125000 \times \left(\frac{102}{100}\right)^3$$

$$= 125000 \times \left(\frac{51}{50}\right)^3$$

$$= 125000 \times \left(\frac{51}{50}\right) \times \left(\frac{51}{50}\right) \times \left(\frac{51}{50}\right)$$

$$= (51 \times 51 \times 51)$$

$$= 132651$$

Therefore, the population of the town after three years is 132651.

Q23.

**Answer :**

Let the population of the town be 50000.

Rate of increase for the first year,  $p = 5\%$

Rate of increase for the second year,  $q = 4\%$

Rate of increase for the third year,  $r = 3\%$

Time = 3 years

$$\text{Now, present population} = \left\{ P \times \left(1 + \frac{p}{100}\right) \times \left(1 + \frac{q}{100}\right) \times \left(1 + \frac{r}{100}\right) \right\}$$

$$= \left\{ 50000 \times \left(1 + \frac{5}{100}\right) \times \left(1 + \frac{4}{100}\right) \times \left(1 + \frac{3}{100}\right) \right\}$$

$$= \left\{ 50000 \times \left(\frac{100+5}{100}\right) \times \left(\frac{100+4}{100}\right) \times \left(\frac{100+3}{100}\right) \right\}$$

$$= \left\{ 50000 \times \left(\frac{105}{100}\right) \times \left(\frac{104}{100}\right) \times \left(\frac{103}{100}\right) \right\}$$

$$= \left\{ 50000 \times \left(\frac{21}{20}\right) \times \left(\frac{26}{25}\right) \times \left(\frac{103}{100}\right) \right\}$$

$$= (21 \times 26 \times 103)$$

$$= 56238$$

Therefore, the present population of the town is 56238.

Q24.

Answer :

Population of the city in 2009,  $P = 120000$

Rate of increase,  $R = 6\%$

Time,  $n = 3$  years

Then the population of the city in the year 2010 is *given by*

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

$$= 120000 \times \left(1 + \frac{6}{100}\right)^1$$

$$= 120000 \times \left(\frac{100+6}{100}\right)$$

$$= 120000 \times \left(\frac{106}{100}\right)$$

$$= 120000 \times \left(\frac{53}{50}\right)$$

$$= 2400 \times 53$$

$$= 127200$$

Therefore, the population of the city in 2010 is 127200.

Again, population of the city in 2010,  $P = 127200$

Rate of decrease,  $R = 5\%$

Then the population of the city in the year 2011 is *given by*

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

$$= 127200 \times \left(1 - \frac{5}{100}\right)^1$$

$$= 127200 \times \left(\frac{100-5}{100}\right)$$

$$= 127200 \times \left(\frac{95}{100}\right)$$

$$= 127200 \times \left(\frac{19}{20}\right)$$

$$= 6360 \times 19$$

$$= 120840$$

Therefore, the population of the city in 2011 is 120840.

Q25.

Answer :

Initial count of bacteria,  $P = 500000$

Rate of increase,  $R = 2\%$

Time,  $n = 2$  hours

Then the count of bacteria at the end of 2 hours is *given by*

$$\text{Count of bacteria} = P \times \left(1 + \frac{R}{100}\right)^n$$

$$= 500000 \times \left(1 + \frac{2}{100}\right)^2$$

$$= 500000 \times \left(\frac{100+2}{100}\right)^2$$

$$= 500000 \times \left(\frac{102}{100}\right)^2$$

$$= 500000 \times \left(\frac{51}{50}\right)^2$$

$$= 500000 \times \left(\frac{51}{50}\right) \times \left(\frac{51}{50}\right)$$

$$= (200 \times 51 \times 51)$$

$$= 520200$$

Therefore, the count of bacteria at the end of 2 hours is 520200.

Q26.

Answer :

Initial count of bacteria,  $P = 20000$

Rate of increase,  $R = 10\%$

Time,  $n = 3$  hours

Then the count of bacteria at the end of the first hour is given by

$$\text{Count of bacteria} = P \times \left(1 + \frac{10}{100}\right)^n$$

$$= 20000 \times \left(1 + \frac{10}{100}\right)^1$$

$$= 20000 \times \left(\frac{100+10}{100}\right)$$

$$= 20000 \times \left(\frac{110}{100}\right)$$

$$= 20000 \times \left(\frac{11}{10}\right)$$

$$= 2000 \times 11$$

$$= 22000$$

Therefore, the count of bacteria at the end of the first hour is 22000.

The count of bacteria at the end of the second hour is given by

$$\text{Count of bacteria} = P \times \left(1 - \frac{10}{100}\right)^n$$

$$= 22000 \times \left(1 - \frac{10}{100}\right)^1$$

$$= 22000 \times \left(\frac{100-10}{100}\right)$$

$$= 22000 \times \left(\frac{90}{100}\right)$$

$$= 22000 \times \left(\frac{9}{10}\right)$$

$$= 2200 \times 9$$

$$= 19800$$

Therefore, the count of bacteria at the end of the second hour is 19800.

Then the count of bacteria at the end of the third hour is given by

$$\text{Count of bacteria} = P \times \left(1 + \frac{10}{100}\right)^n$$

$$= 19800 \times \left(1 + \frac{10}{100}\right)^1$$

$$= 19800 \times \left(\frac{100+10}{100}\right)$$

$$= 19800 \times \left(\frac{110}{100}\right)$$

$$= 19800 \times \left(\frac{11}{10}\right)$$

$$= 1980 \times 11$$

$$= 21780$$

Therefore, the count of bacteria at the end of the first 3 hours is 21780.

Q27.

Answer :

Initial value of the machine,  $P = \text{Rs } 625000$

Rate of depreciation,  $R = 8\%$

Time,  $n = 2$  years

Then the value of the machine after two years is given by

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

$$= \text{Rs } 625000 \times \left(1 - \frac{8}{100}\right)^2$$

$$= \text{Rs } 625000 \times \left(\frac{100-8}{100}\right)^2$$

$$= \text{Rs } 625000 \times \left(\frac{92}{100}\right)^2$$

$$= \text{Rs } 625000 \times \left(\frac{23}{25}\right)^2$$

$$= \text{Rs } 625000 \times \left(\frac{23}{25}\right) \times \left(\frac{23}{25}\right)$$

$$= \text{Rs } (1000 \times 23 \times 23)$$

$$= \text{Rs } 529000$$

Therefore, the value of the machine after two years will be Rs. 529000.

Q28.

**Answer :**

Initial value of the scooter,  $P = \text{Rs } 56000$

Rate of depreciation,  $R = 10\%$

Time,  $n = 3$  years

Then the value of the scooter after three years is given by

$$\begin{aligned}\text{Value} &= P \times \left(1 - \frac{R}{100}\right)^n \\&= \text{Rs. } 56000 \times \left(1 - \frac{10}{100}\right)^3 \\&= \text{Rs. } 56000 \times \left(\frac{100-10}{100}\right)^3 \\&= \text{Rs. } 56000 \times \left(\frac{90}{100}\right)^3 \\&= \text{Rs. } 56000 \times \left(\frac{9}{10}\right)^3 \\&= \text{Rs. } 56000 \times \left(\frac{9}{10}\right) \times \left(\frac{9}{10}\right) \times \left(\frac{9}{10}\right) \\&= \text{Rs. } (56 \times 9 \times 9 \times 9) \\&= \text{Rs. } 40824\end{aligned}$$

Therefore, the value of the scooter after three years will be Rs. 40824.

Q29.

**Answer :**

Initial value of the car,  $P = \text{Rs } 348000$

Rate of depreciation for the first year,  $p = 10\%$

Rate of depreciation for the second year,  $q = 20\%$

Time,  $n = 2$  years.

Then the value of the car after two years is given by

$$\begin{aligned}\text{Value} &= \left\{P \times \left(1 - \frac{p}{100}\right) \times \left(1 - \frac{q}{100}\right)\right\} \\&= \text{Rs. } \left\{348000 \times \left(1 - \frac{10}{100}\right) \times \left(1 - \frac{20}{100}\right)\right\} \\&= \text{Rs. } \left\{348000 \times \left(\frac{100-10}{100}\right) \times \left(\frac{100-20}{100}\right)\right\} \\&= \text{Rs. } \left\{348000 \times \left(\frac{90}{100}\right) \times \left(\frac{80}{100}\right)\right\} \\&= \text{Rs. } \left\{348000 \times \left(\frac{9}{10}\right) \times \left(\frac{8}{10}\right)\right\} \\&= \text{Rs. } (3480 \times 9 \times 8) \\&= \text{Rs. } 250560 \\&\therefore \text{The value of the car after two years is Rs } 250560.\end{aligned}$$

Q30.

**Answer :**

Let the initial value of the machine,  $P$  be Rs  $x$ .

Rate of depreciation,  $R = 10\%$

Time,  $n = 3$  years

The present value of the machine is Rs 291600.

Then the initial value of the machine is given by

$$\begin{aligned}\text{Value} &= P \times \left(1 - \frac{R}{100}\right)^n \\&= \text{Rs. } x \times \left(1 - \frac{10}{100}\right)^3 \\&= \text{Rs. } x \times \left(\frac{100-10}{100}\right)^3 \\&= \text{Rs. } x \times \left(\frac{90}{100}\right)^3 \\&= \text{Rs. } x \times \left(\frac{9}{10}\right)^3 \\&\therefore \text{Present value of the machine} = \text{Rs } 291600 \\&\text{Now, Rs } 291600 = \text{Rs } x \times \left(\frac{9}{10}\right) \times \left(\frac{9}{10}\right) \times \left(\frac{9}{10}\right) \\&\Rightarrow x = \text{Rs } \frac{291600 \times 10 \times 10 \times 10}{9 \times 9 \times 9} \\&\Rightarrow x = \text{Rs } \frac{291600000}{729} \\&\Rightarrow x = \text{Rs } 400000 \\&\therefore \text{The initial value of the machine is Rs } 400000.\end{aligned}$$



# Compound Interest

## Ex 11C

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 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> 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:

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

### **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 1<sup>st</sup>, 2<sup>nd</sup> and  
3<sup>rd</sup> 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.

Similarly, if  $V_0$  is the value  $n$  years ago and  $V$  is the present value, then

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

8. Population :

(i) Population after  $n$  years = Present

$$\text{population} \left( 1 + \frac{r}{100} \right)^n$$

(ii) Present population = Population  $n$

$$\text{years ago} \left( 1 + \frac{r}{100} \right)^n$$

Q1.

Answer :

Principal,  $P = \text{Rs. } 8000$

Time,  $n = 1 \text{ year} = 2 \text{ half years}$

Rate of interest per annum = 10%

Rate of interest for half year,  $R = \frac{10\%}{2} = 5\%$

The amount with the compound interest is given by

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

$$= \text{Rs. } 8000 \times \left( 1 + \frac{5}{100} \right)^2$$

$$= \text{Rs. } 8000 \times \left( \frac{105}{100} \right)^2$$

$$= \text{Rs. } 8000 \times \left( \frac{21}{20} \right)^2$$

$$= \text{Rs. } 8000 \times \left( \frac{21}{20} \right) \times \left( \frac{21}{20} \right)$$

$$= \text{Rs. } (20 \times 21 \times 21)$$

$$= \text{Rs. } 8820$$

$$\therefore \text{Compound interest} = \text{amount} - \text{principal} = \text{Rs. } (8820 - 8000) = \text{Rs. } 820$$

Q3.

Principal,  $P = \text{Rs. } 12800$

Annual rate of interest,  $R = \frac{15}{2} \%$

Rate of interest for a half year  $= \frac{1}{2} \left( \frac{15}{2} \right) \% = \frac{15}{4} \%$

Time,  $n = 1 \text{ year} = 2 \text{ half years}$

Then the amount with the compound interest is given by

$$\begin{aligned} A &= P \times \left( 1 + \frac{R}{100} \right)^n \\ &= 12800 \times \left( 1 + \frac{\frac{15}{4}}{100} \right)^2 \\ &= 12800 \times \left( 1 + \frac{15}{100 \times 4} \right)^2 \\ &= 12800 \times \left( \frac{400+15}{400} \right)^2 \\ &= 12800 \times \left( \frac{415}{400} \right)^2 \\ &= 12800 \times \left( \frac{83}{80} \right) \times \left( \frac{83}{80} \right) \\ &= (2 \times 83 \times 83) \\ &= \text{Rs } 13778 \end{aligned}$$

Therefore, compound interest = amount - principal = Rs  $\left( 13778 - 12800 \right) = \text{Rs}$

978

Q4.

**Answer :**

Principal,  $P = \text{Rs. } 160000$

Annual rate of interest,  $R = 10\%$

Rate of interest for a half year  $= \frac{10}{2} \% = 5\%$

Time,  $n = 2 \text{ years} = 4 \text{ half years}$

Then the amount with the compound interest is given by

$$\begin{aligned} A &= P \times \left( 1 + \frac{R}{100} \right)^n \\ &= 160000 \times \left( 1 + \frac{5}{100} \right)^4 \\ &= 160000 \times \left( \frac{100+5}{100} \right)^4 \\ &= 160000 \times \left( \frac{105}{100} \right)^4 \\ &= 160000 \times \left( \frac{21}{20} \right) \times \left( \frac{21}{20} \right) \times \left( \frac{21}{20} \right) \times \left( \frac{21}{20} \right) \\ &= (21 \times 21 \times 21 \times 21) \\ &= \text{Rs } 194481 \end{aligned}$$

Therefore, compound interest = amount - principal = Rs  $\left( 194481 - 160000 \right) =$

Rs 34481

Q5.

Principal,  $P = \text{Rs. } 40960$

Annual rate of interest,  $R = \frac{25}{2} \%$

Rate of interest for half year  $= \frac{25}{4} \%$

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

Then the amount with the compound interest is given by

$$\begin{aligned} A &= P \times \left(1 + \frac{R}{100}\right)^n \\ &= 40960 \times \left(1 + \frac{25}{100 \times 4}\right)^3 \\ &= 40960 \times \left(\frac{400+25}{400}\right)^3 \\ &= 40960 \times \left(\frac{425}{400}\right)^3 \\ &= 40960 \times \left(\frac{17}{16}\right) \times \left(\frac{17}{16}\right) \times \left(\frac{17}{16}\right) \\ &= (10 \times 17 \times 17 \times 17) \\ &= \text{Rs } 49130 \end{aligned}$$

Therefore, compound interest = amount - principal = Rs  $\left(49130 - 40960\right) = \text{Rs } 8170$

Therefore, Swati has to pay Rs. 49130, which includes an interest of Rs. 8170, to the bank after  $1\frac{1}{2}$  years.

Q6.

Answer :

Let the principal amount be  $P = \text{Rs. } 125000$ .

Annual rate of interest,  $R = 12\%$

Rate of interest for a half year  $= 6\%$

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

Then the amount with the compound interest is given by

$$\begin{aligned} A &= P \times \left(1 + \frac{R}{100}\right)^n \\ &= \text{Rs. } 125000 \times \left(1 + \frac{6}{100}\right)^3 \\ &= \text{Rs. } 125000 \times \left(\frac{100+6}{100}\right)^3 \\ &= \text{Rs. } 125000 \times \left(\frac{106}{100}\right)^3 \\ &= \text{Rs. } 125000 \times \left(\frac{53}{50}\right) \times \left(\frac{53}{50}\right) \times \left(\frac{53}{50}\right) \\ &= \text{Rs. } (53 \times 53 \times 53) \\ &= \text{Rs. } 148877 \end{aligned}$$

Now,  $CI = A - P = \text{Rs. } \left(148877 - 125000\right) = \text{Rs. } 23877$

Therefore, Aslam has to pay an interest of Rs. 23877 to the bank after  $1\frac{1}{2}$  years.

Q7.

Answer :

Let the principal amount be  $P = \text{Rs. } 20000$ .

Annual rate of interest,  $R = 6\%$

Rate of interest for half year  $= 3\%$

Time,  $n = 1 \text{ year} = 2 \text{ half years}$

Then the amount with the compound interest is given by

$$\begin{aligned} A &= P \times \left(1 + \frac{R}{100}\right)^n \\ &= \text{Rs. } 20000 \times \left(1 + \frac{3}{100}\right)^2 \\ &= \text{Rs. } 20000 \times \left(\frac{100+3}{100}\right)^2 \\ &= \text{Rs. } 20000 \times \left(\frac{103}{100}\right)^2 \\ &= \text{Rs. } 20000 \times \left(\frac{103}{100}\right) \times \left(\frac{103}{100}\right) \\ &= \text{Rs. } (2 \times 103 \times 103) \\ &= \text{Rs. } 21218 \end{aligned}$$

Therefore, Sheela gets Rs. 21218 after 1 year.

Q8.

Answer :

Let the principal amount be  $P = \text{Rs. } 65536$ .

Annual rate of interest,  $R = \frac{25}{2}\%$

Rate of interest for a half year  $= \frac{25}{4}\%$

Time,  $n = 2 \text{ years} = 4 \text{ half years}$

Then the amount with the compound interest is given by

$$\begin{aligned} A &= P \times \left(1 + \frac{R}{100}\right)^n \\ &= \text{Rs. } 65536 \times \left(1 + \frac{25}{100 \times 4}\right)^4 \\ &= \text{Rs. } 65536 \times \left(\frac{400+25}{400}\right)^4 \\ &= \text{Rs. } 65536 \times \left(\frac{425}{400}\right)^4 \\ &= \text{Rs. } 65536 \times \left(\frac{17}{16}\right)^4 \\ &= \text{Rs. } 65536 \times \left(\frac{17}{16}\right) \times \left(\frac{17}{16}\right) \times \left(\frac{17}{16}\right) \times \left(\frac{17}{16}\right) \\ &= \text{Rs. } (17 \times 17 \times 17 \times 17) \\ &= \text{Rs. } 83521 \end{aligned}$$

Now,  $CI = A - P$

$$= \text{Rs. } (83521 - 65536) = \text{Rs. } 17985$$

Therefore, interest earned when compounded half yearly  $= \text{Rs. } 17985$

Amount when the interest is compounded yearly is given by

$$\begin{aligned} A &= P \times \left(1 + \frac{R}{100}\right)^n \\ &= \text{Rs. } 65536 \times \left(1 + \frac{25}{100 \times 2}\right)^2 \\ &= \text{Rs. } 65536 \times \left(\frac{200+25}{200}\right)^2 \\ &= \text{Rs. } 65536 \times \left(\frac{225}{200}\right)^2 \\ &= \text{Rs. } 65536 \times \left(\frac{9}{8}\right)^2 \\ &= \text{Rs. } 65536 \times \left(\frac{9}{8}\right) \times \left(\frac{9}{8}\right) \\ &= \text{Rs. } 82944 \end{aligned}$$

$$\text{Therefore, } CI = A - P = \text{Rs. } (82944 - 65536) = \text{Rs. } 17408$$

$\therefore$  Difference between the interests compounded half yearly and yearly  $= \text{Rs.}$

$$(17985 - 17408) = \text{Rs. } 577$$

Q9.

Answer :

Let the principal amount be  $P = \text{Rs } 32000$ .

Annual rate of interest,  $R = 5\%$

Rate of interest for a quarter year  $= \frac{5}{4} \%$

Time,  $n = 6 \text{ months} = 2 \text{ quarter years}$

Then the amount with the compound interest is given by

$$\begin{aligned} A &= \text{Rs. } P \times \left(1 + \frac{R}{100}\right)^n \\ &= \text{Rs. } 32000 \times \left(1 + \frac{5}{100 \times 4}\right)^2 \\ &= \text{Rs. } 32000 \times \left(\frac{400+5}{400}\right)^2 \\ &= \text{Rs. } 32000 \times \left(\frac{405}{400}\right)^2 \\ &= \text{Rs. } 32000 \times \left(\frac{81}{80}\right)^2 \\ &= \text{Rs. } 32000 \times \left(\frac{81}{80}\right) \times \left(\frac{81}{80}\right) \\ &= \text{Rs. } (5 \times 81 \times 81) \\ &= \text{Rs. } 32805 \end{aligned}$$

Therefore, Sudershan will receive an amount of Rs. 32805 after 6 months.

Q10.

Let the principal amount be  $P = \text{Rs } 390625$ .

Annual rate of interest,  $R = 16\%$

Rate of interest for a quarter year  $= \frac{16}{4} \% = 4\%$

Time,  $n = 1 \text{ year} = 4 \text{ quarter years}$

Then the amount with the compound interest is given by

$$\begin{aligned} A &= \text{Rs. } P \times \left(1 + \frac{R}{100}\right)^n \\ &= \text{Rs. } 390625 \times \left(1 + \frac{4}{100}\right)^4 \\ &= \text{Rs. } 390625 \times \left(\frac{100+4}{100}\right)^4 \\ &= \text{Rs. } 390625 \times \left(\frac{104}{100}\right)^4 \\ &= \text{Rs. } 390625 \times \left(\frac{26}{25}\right)^4 \\ &= \text{Rs. } 390625 \times \left(\frac{26}{25}\right) \times \left(\frac{26}{25}\right) \times \left(\frac{26}{25}\right) \times \left(\frac{26}{25}\right) \\ &= \text{Rs. } (26 \times 26 \times 26 \times 26) \\ &= \text{Rs. } 456976 \end{aligned}$$

Therefore, Arun has to pay Rs 456976 after 1 year.

# Compound Interest

## Ex 11D

Q1.

**Answer :**

(c) Rs. 832

$$\begin{aligned}A &= P \times \left(1 + \frac{R}{100}\right)^n \\&= \text{Rs. } 5000 \times \left(1 + \frac{8}{100}\right)^2 \\&= \text{Rs. } 5000 \times \left(\frac{108}{100}\right)^2 \\&= \text{Rs. } 5000 \times \left(\frac{27}{25}\right)^2 \\&= \text{Rs. } 5000 \times \left(\frac{27}{25}\right) \times \left(\frac{27}{25}\right) \\&= \text{Rs. } (8 \times 27 \times 27) \\&= \text{Rs. } 5832 \\ \therefore \text{Interest} &= \text{amount} - \text{principal} = \text{Rs } (5832 - 5000) = \text{Rs } 832\end{aligned}$$

Q2.

**Answer :**

(b) Rs. 3310

$$\begin{aligned}A &= P \times \left(1 + \frac{R}{100}\right)^n \\&= \text{Rs. } 10000 \times \left(1 + \frac{10}{100}\right)^3 \\&= \text{Rs. } 10000 \times \left(\frac{110}{100}\right)^3 \\&= \text{Rs. } 10000 \times \left(\frac{11}{10}\right)^3 \\&= \text{Rs. } 10000 \times \left(\frac{11}{10}\right) \times \left(\frac{11}{10}\right) \times \left(\frac{11}{10}\right) \\&= \text{Rs. } (10 \times 11 \times 11 \times 11) \\&= \text{Rs. } 13310 \\ \therefore \text{Compound interest} &= \text{amount} - \text{principal} = \text{Rs } (13310 - 10000) = \text{Rs } 3310\end{aligned}$$

Q3.

**Answer :**

(a) Rs 1872

$$\begin{aligned}\text{Here, } A &= P \times \left(1 + \frac{R}{100}\right)^1 \times \left(1 + \frac{\frac{1}{2}R}{100}\right) \\&= \text{Rs } 10000 \times \left(1 + \frac{12}{100}\right) \times \left(1 + \frac{\frac{1}{2} \times 12}{100}\right) \\&= \text{Rs } 10000 \times \left(\frac{100+12}{100}\right) \times \left(\frac{100+6}{100}\right) \\&= \text{Rs } 10000 \times \left(\frac{112}{100}\right) \times \left(\frac{106}{100}\right) \\&= \text{Rs } 10000 \times \left(\frac{28}{25}\right) \times \left(\frac{53}{50}\right) \\&= \text{Rs } (8 \times 28 \times 53) \\&= \text{Rs } 11872\end{aligned}$$

$$\therefore \text{Compound interest} = \text{amount} - \text{principal} = \text{Rs } \left(11872 - 10000\right) = \text{Rs } 1872$$

Q4.

**Answer :**

(c) Rs 961

$$\begin{aligned}\text{Here, } A &= P \times \left(1 + \frac{R}{100}\right)^2 \times \left(1 + \frac{\frac{1}{4}R}{100}\right) \\&= \text{Rs. } 4000 \times \left(1 + \frac{10}{100}\right)^2 \times \left(1 + \frac{\frac{1}{4} \times 10}{100}\right) \\&= \text{Rs. } 4000 \times \left(\frac{100+10}{100}\right)^2 \times \left(\frac{40+1}{40}\right) \\&= \text{Rs. } 4000 \times \left(\frac{110}{100}\right)^2 \times \left(\frac{41}{40}\right) \\&= \text{Rs. } 4000 \times \left(\frac{11}{10}\right) \times \left(\frac{11}{10}\right) \times \left(\frac{41}{40}\right) \\&= \text{Rs. } (11 \times 11 \times 41) \\&= \text{Rs. } 4961\end{aligned}$$

$$\therefore \text{Compound interest} = \text{amount} - \text{principal} = \text{Rs } \left(4961 - 4000\right) = \text{Rs } 961$$

Q5.

**Answer :**

(b) Rs. 5051

$$\begin{aligned}\text{Here, } A &= \text{Rs. } P \times \left(1 + \frac{p}{100}\right) \times \left(1 + \frac{q}{100}\right) \times \left(1 + \frac{r}{100}\right) \\&= \text{Rs. } 25000 \times \left(1 + \frac{5}{100}\right) \times \left(1 + \frac{6}{100}\right) \times \left(1 + \frac{8}{100}\right) \\&= \text{Rs. } 25000 \times \left(\frac{105}{100}\right) \times \left(\frac{106}{100}\right) \times \left(\frac{108}{100}\right) \\&= \text{Rs. } 25000 \times \left(\frac{21}{20}\right) \times \left(\frac{53}{50}\right) \times \left(\frac{27}{25}\right) \\&= \text{Rs. } (21 \times 53 \times 27) \\&= \text{Rs. } 30051\end{aligned}$$

$$\therefore \text{Compound interest} = \text{amount} - \text{principal} = \text{Rs. } \left(30051 - 25000\right) = \text{Rs. } 5051$$

Q6.



**Answer :**

(b) Rs. 510

Rate of interest compounded half yearly =  $\frac{8}{2}\% = 4\%$

Time = 1 year = 2 half years

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

$$= \text{Rs. } 6250 \times \left(1 + \frac{4}{100}\right)^2$$

$$= \text{Rs. } 6250 \times \left(\frac{104}{100}\right)^2$$

$$= \text{Rs. } 6250 \times \left(\frac{26}{25}\right) \times \left(\frac{26}{25}\right)$$

$$= \text{Rs. } (10 \times 26 \times 26)$$

$$= \text{Rs. } 6760$$

$$\therefore \text{Compound interest} = \text{amount} - \text{principal} = \text{Rs. } (6760 - 6250) = \text{Rs. } 510$$

Q7.

**Answer :**

(a) Rs.1209

Time = 6 months = 2 quater years

Rate compounded quater yearly =  $\frac{6}{4}\% = \frac{3}{2}\%$

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

$$= \text{Rs. } 40000 \times \left(1 + \frac{3}{100 \times 2}\right)^2$$

$$= \text{Rs. } 40000 \times \left(\frac{203}{200}\right)^2$$

$$= \text{Rs. } 40000 \times \left(\frac{203}{200}\right) \times \left(\frac{203}{200}\right)$$

$$= \text{Rs. } (203 \times 203)$$

$$= \text{Rs. } 41209$$

$$\therefore \text{Compound interest} = \text{amount} - \text{principal} = \text{Rs. } 41209 - \text{Rs. } 40000 = \text{Rs. } 1209$$

Q8.

**Answer :**

(b) 26460

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

$$= \text{Rs. } 24000 \times \left(1 + \frac{5}{100}\right)^2$$

$$= \text{Rs. } 24000 \times \left(\frac{105}{100}\right)^2$$

$$= \text{Rs. } 24000 \times \left(\frac{21}{20}\right) \times \left(\frac{21}{20}\right)$$

$$= \text{Rs. } (60 \times 21 \times 21)$$

$$= \text{Rs. } 26460$$

Q9.

**Answer :**

(c) Rs. 43740

Here,  $A = \text{Rs. } P \times \left(1 - \frac{R}{100}\right)^n$

$$= \text{Rs. } 60000 \times \left(1 - \frac{10}{100}\right)^3$$

$$= \text{Rs. } 60000 \times \left(\frac{90}{100}\right)^3$$

$$= \text{Rs. } 60000 \times \left(\frac{9}{10}\right) \times \left(\frac{9}{10}\right) \times \left(\frac{9}{10}\right)$$

$$= \text{Rs. } (60 \times 9 \times 9 \times 9)$$

$$= \text{Rs. } 43740$$

Q10.

**Answer :**

(b) Rs. 62500

$$\begin{aligned}\text{Here, } A &= P \times \left(1 - \frac{R}{100}\right)^n \\&= P \times \left(1 - \frac{20}{100}\right)^2 \\&= P \times \left(\frac{80}{100}\right)^2 \\&= P \times \left(\frac{4}{5}\right) \times \left(\frac{4}{5}\right) \\&\Rightarrow 40000 = \frac{16P}{25} \\&\therefore P = \frac{40000 \times 25}{16} = \text{Rs } 62500\end{aligned}$$

Q11.

**Answer :**

(a) 25000

Let  $P$  be the population 3 years ago.

Now, present population = 33275

$$\begin{aligned}\Rightarrow 33275 &= P \times \left(1 + \frac{10}{100}\right)^3 \\&\Rightarrow 33275 = P \times \left(\frac{110}{100}\right)^3 \\&\Rightarrow 33275 = P \times \left(\frac{11}{10}\right) \times \left(\frac{11}{10}\right) \times \left(\frac{11}{10}\right) \\&\Rightarrow 33275 = \frac{1331P}{1000} \\&\therefore P = \frac{33275 \times 1000}{1331} = 25000\end{aligned}$$

Q12.

**Answer :**

(d) Rs 1261

$$\begin{aligned}\text{Here, SI} &= \frac{P \times 5 \times 3}{100} \\&\Rightarrow 1200 = \frac{P \times 5 \times 3}{100} \\&\Rightarrow P = \frac{1200 \times 100}{5 \times 3} = \text{Rs } 8000\end{aligned}$$

$$\begin{aligned}\text{Amount at the end of 3 years} &= \text{Rs } 8000 \times \left(1 + \frac{5}{100}\right)^3 \\&= \text{Rs } 8000 \times \left(\frac{105}{100}\right)^3 \\&= \text{Rs } 8000 \times \left(\frac{21}{20}\right) \times \left(\frac{21}{20}\right) \times \left(\frac{21}{20}\right) \\&= \text{Rs } (21 \times 21 \times 21) \\&= \text{Rs } 9261 \\&\therefore \text{CI} = A - P = \text{Rs } (9261 - 8000) = \text{Rs } 1261\end{aligned}$$

Q13.

**Answer :**

(d) Rs 480

$$\begin{aligned}\text{We have: } 510 &= \left\{ P \times \left(1 + \frac{25}{100 \times 2}\right)^2 \right\} - P \\&\Rightarrow 510 \Rightarrow \left\{ P \times \left(\frac{8+1}{8}\right)^2 \right\} - P \\&\Rightarrow 510 = \left\{ P \times \left(\frac{9}{8}\right) \times \left(\frac{9}{8}\right) \right\} - P \\&\Rightarrow 510 = \left(\frac{81P}{64} - P\right) \\&\Rightarrow 510 = \left(\frac{81P - 64P}{64}\right) \\&\Rightarrow 510 = \frac{17P}{64} \\&\therefore P = \frac{510 \times 64}{17} = \text{Rs } 1920 \\&\text{Now, SI} = \frac{P \times R \times T}{100} \\&= \text{Rs } \frac{1920 \times 2 \times 25}{100 \times 2} = \text{Rs } 480\end{aligned}$$

Q14.

**Answer :**

(d) Rs 4096

$$\begin{aligned}\text{We have Rs } 4913 &= \left\{ P \times \left( 1 + \frac{25}{100 \times 4} \right)^3 \right\} \\ \Rightarrow \text{Rs } 4913 &= \left\{ P \times \left( \frac{16+1}{16} \right)^3 \right\} \\ \Rightarrow \text{Rs } 4913 &= \left\{ P \times \left( \frac{17}{16} \right) \times \left( \frac{17}{16} \right) \times \left( \frac{17}{16} \right) \right\} \\ \Rightarrow \text{Rs } 4913 &= \frac{4913P}{4096} \\ \Rightarrow P &= \text{Rs } \frac{4913 \times 4096}{4913} = \text{Rs } 4096\end{aligned}$$

Q15.

**Answer :**

(c) 6%

$$\begin{aligned}\text{Here, } A &= P \times \left( 1 + \frac{R}{100} \right) \\ &= \text{Rs. } 7500 \times \left( 1 + \frac{R}{100} \right)^2 \\ &= \text{Rs. } 7500 \times \left( 1 + \frac{R}{100} \right)^2 \\ \text{However, amount} &= \text{Rs. } 8427 \\ \text{Now, Rs. } 8427 &= \text{Rs. } 7500 \times \left( 1 + \frac{R}{100} \right)^2 \\ \Rightarrow \frac{\text{Rs. } 8427}{\text{Rs. } 7500} &= \left( 1 + \frac{R}{100} \right)^2 \\ \Rightarrow \left( \frac{53}{50} \right)^2 &= \left( 1 + \frac{R}{100} \right)^2 \\ \Rightarrow \left( 1 + \frac{R}{100} \right) &= \left( \frac{53}{50} \right) \\ \Rightarrow \frac{R}{100} &= \frac{53}{50} - 1 \\ \Rightarrow \frac{R}{100} &= \frac{53-50}{50} = \frac{3}{50} \\ \therefore R &= \frac{300}{50} = 6\%\end{aligned}$$