COMPOUND INTEREST.

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:

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

Find the amount and the compound interest on Rs. 16000 for 3 years at 5% per annum compounded annually.

Principal(P)= Rs. 16000

Time(t) = 3 years

Rate(r)=5%

$$\text{Amount} = \text{Principal} \times \left(1 + \frac{r}{100}\right)^{t}$$

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

$$= \text{Rs. } 16000 \times \left(\frac{21}{20}\right)^{3}$$

$$= \text{Rs. } 16000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20}$$

$$= \text{Rs. } 18522$$

C.I= Amount-Principal

=Rs. 18522 - Rs. 16000 = Rs. 2522

If a certain sum of money becomes 9 times itself in 2 years. Find the rate of compound interest?

Let the principal be 'P'.

$\Rightarrow A = P(1 + r/100)^t$

$\Rightarrow 9P = P(1 + r/100)^2$

$\Rightarrow 9 = (1 + r/100)^2$

$\Rightarrow \sqrt{9} = 1 + r/100$

$\Rightarrow 3 = 1 + r/100$

$\Rightarrow 300 = 100 + r$

$\Rightarrow r = 200\%$

The compound interest on Rs 8,000 at 20% per annum for 9 months compounded quarterly is

We know formula for compound interest compounded quarterly

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

Compound Interest = Amount – Principal

Given,

principal=Rs8000

Time=9months=9/12months

Rate=20%

$$= 8000\left(1 + \frac{.2}{4}\right)^{\frac{9}{12}\times 4}$$

$$= 8000(1 + 0.05)^3$$

$$= 8000(1.05)^3$$

$$= 8000 \times 1.15762 = 9261$$

Amount is Rs9261

Compound interest will be=(9261-8000)=Rs1261

A sum of money placed at compound interest doubles itself in 4 years. In how many years will it amount to 8 times?

$A = P \times [1 + (r/100)]^{n}$

Here, $A = 2P$, $n = 4$ years

$\Rightarrow A = P \times [1 + (r/100)]^{n}$

$\Rightarrow 2P = P \times [1 + (r/100)]^{4}$

$\Rightarrow 2 = [1 + (r/100)]^{4}$ ----(1)

If sum becomes 8 times in n years,

Then, $A = 8P$

$\Rightarrow 8P = P \times [1 + (r/100)]^{n}$

$\Rightarrow 8 = [1 + (r/100)]^{n}$

$\Rightarrow 2^{3} = [1 + (r/100)]^{n}$ ----(2)

From equation (1) and (2), we get;

$\Rightarrow \{[1 + (r/100)]^{4}\}^{3} = [1 + (r/100)]^{n}$

$\Rightarrow [1 + (r/100)]^{12} = [1 + (r/100)]^{n}$

$\Rightarrow n = 12$ years

$\therefore$ A sum of money will amount to its 8 times in 12 years.

The compound interest on a certain sum for 2 years. Rs.40.80 and the simple interest is Rs.40. Find the sum

$$\text{Rate} = \frac{2 \times \text{Difference in Compund and Simple Interest}}{\text{Simple Interest}} \times 100$$

$$Rate = \frac{2 \times 0.80}{40} \times 100 = 4\%$$

$$Simple\ Interest = \frac{Pnr}{100}$$

$$40 = \frac{P \times 2 \times 4}{100}$$

P= Rs. 500

The compound interest on a certain sum for 2 years. Rs.40.80 and the simple interest is Rs.40. Find the sum

Let us assume the sum and the rate of interest are P and R respectively

⇒ The simple interest for one year at a certain rate of interest = 40/2 = 20

⇒ The rate of interest = $\frac{40.80 - 40}{20} \times 100 = 4\%$

⇒ $40.80 - 40 = P \times (\frac{4}{100})^2$

⇒ $0.80 = \frac{16P}{10000}$

⇒ P = 500

Manish invested a sum of money at CI. It amounted to Rs 2420 in 2 years and Rs 2662 in 3 years. Find the rate percent per annum.

Amount for 3 years = A_3 = Rs. 2662 = $P \times (1 + r/100)^3$ ____(1)

Amount for 2 years = A_2 = Rs. 2420 = $P \times (1 + r/100)^2$ ____(2)

1.÷ (2) gives $2662 / 2420 = 1 + r/100$

$\Rightarrow 11 / 10 = 1 + r/100$

$\Rightarrow 11/10 - 1 = r/100$

$\Rightarrow 1/10 = r/100$

$\Rightarrow r = 10\%$

A sum of money is invested at compound interest payable annually. The interest in two successive years is ₹225 and ₹240. Find the rate of interest.

Interest for first year = ₹225

Interest for second year = ₹240.

Difference = ₹15.

Here, ₹15 is the interest on ₹225 for 1 year.

(i) We know that,

$$\text{Rate} = \frac{S.I. \times 100}{P \times T}$$

$$= \frac{15 \times 100}{225 \times 1}$$

$$= \frac{20}{3}$$

$$= 6\frac{2}{3}\%.$$

Hence, rate of interest = $6\frac{2}{3}\%$.

If the rate of interest be 4% per annum for first year, 5% per annum for second year, and 6% per annum for third year, then what is the compound interest on Rs.10000 for 3 years ?

$$A = P\left(1+\frac{r_1}{100}\right)\left(1+\frac{r_2}{100}\right)\left(1+\frac{r_3}{100}\right)$$

$$\Rightarrow A = 10000\left(1+\frac{4}{100}\right)\left(1+\frac{5}{100}\right)\left(1+\frac{6}{100}\right)$$

$$= 10000 \times \frac{104}{100} \times \frac{105}{100} \times \frac{106}{100} = \text{Rs.}11575.20$$

$$\therefore \text{C.I.} = \text{Rs.}11575.20 - \text{Rs.}10000 = \text{Rs.}1575.20$$

The Compound Interest on a certain sum for 2 years at 10% is Rs. 2100. What will be the Simple Interest for the same period, on the same sum and at the same rate?

$\Rightarrow CI = P\left[(1 + r/100)^t - 1\right]$

$\Rightarrow 2100 = P\left[(1 + 10/100)^2 - 1\right]$

$\Rightarrow 2100 = P\left[121/100 - 1\right]$

$\Rightarrow 2100 = P\left[(121 - 100)/100\right]$

$\Rightarrow P = 2100 \times 100/21$

$\Rightarrow P = 10000$

Now,

$\Rightarrow SI = Prt/100$

$\Rightarrow SI = (10{,}000 \times 10 \times 2)/100$

$\Rightarrow SI = 2000$