INTEREST

SIMPLE INTEREST

Simple interest is an interest that is calculated only on the amount of money invested or borrowed.

There is only one formula to calculate the simple interest.

Formula for simple interest: **I = Pnr**

Where,   I – Interest,
P – Principal amount,
n – No. of period   and
r – rate of interest.

Eg 1 : Find the simple interest on Rs. 3000 at a 7% rate of annual interest for one year.

I = Pnr   P = 3000,   n = 1 year,   r = 7 % = 7/100 = 0.07

= 3000 x 1 x 0.07

= Rs. 210

Eg 2 : Find the simple interest on Rs. 5000 at a 8 % rate of annual interest for 5 years.

I = Pnr   P = 5000,   n = 5 years,   r = 8 % = 8/100 = 0.08

= 5000 x 5 x 0.08

= Rs. 2000

Eg 3 : Find the simple interest on Rs. 10,000 at a 12 % rate of annual interest for 6 months.

I = Pnr   P = 10,000,   n = 6 months = 6/12 year,   r = 12% = 12/100 = 0.12

$= 10,000 \times \dfrac{6}{12} \times 0.12$

= Rs. 600

Eg 4 : Find the simple interest on Rs. 24,000 at a 10 % rate of annual interest for 2 months.

I = Pnr   P = 24,000,   n = 2 months = 2/12 year,   r = 10% = 10/100 = 0.10

$= 24,000 \times \dfrac{2}{12} \times 0.10$

= Rs. 400

COMPOUND INTEREST

Compound interest is the addition of interest to the principal sum of a loan or deposit.

Formula for calculate compound interest : $$S = P \, (1+r)^n$$

Where, S – Value after *n* period,
P – Principal amount,
n – No. of period   and
r – rate of interest.

Eg 1 : A person who borrowed an amount of Rs. 25,000 at 12 % an annual rate of compound interest for a period of 4 years compounded annually. Compute the interest and the total amount payable to get relived of the loan at the end of the same period.

$S = P \, (1 + r)^n$ P = 25000,   n = 4,   r = 12 % = 12/100 = 0.12

$= 25000 \, (1 + 0.12)^4$ = 25000 x 1.57

= Rs. 39,250 ⟵ Total amount payable

Interest (I) = Total amount payable – principal amount

= 39,250 – 25,000   = Rs. 14,250

Eg 2 : A person who borrowed an amount of Rs. 15,000 at 4 % of an annual rate of compound interest for a period of 3 years compounded once in six months. Compute the interest and the total amount payable to get relived of the loan at the end of the same period..

P = 15000,

r = 4 % (for 12 months) So, r = $\dfrac{4\%}{12\ months} \times 6\ months$ = 2 % (for 6 months) = 2/100 = 0.02

n = 3 x 2 = 6 (In 1 year = 2 six months,   So, 3 years ⟶ 3 x 2 = 6 six months)

S = $P \, (1 + r)^n$

= $15000 \, (1 + 0.02)^6$ = 15000 x 1.13

= Rs. 16,950 ⟵ Total amount payable

Interest (I) = Total amount payable – principal amount

= 16,950 – 15,000   = Rs. 1,950

Eg 3 : A person who borrowed an amount of Rs. 10,000 at 12 % of an annual rate interest compounding once in a quarter. Compute the interest and the total amount payable after the period of 3 years.

P = 10000,

r = 12 % (for 12 months) So, $r = \dfrac{12\ \%}{12\ months} \times 3\ months$ = 3 % (for 1quarter) = 3/100 = 0.03

n = 3 x 4 = 12 (In 1 year = 4 quarters,   So, 3 years $\longrightarrow$ 3 x 4 = 12 quarters)

$$S = P\,(1 + r)^n$$

$$= 10000\,(1 + 0.03)^{12} = 10000\,(1.03)^{12}$$

$$= Rs.\ 14{,}257.61 \longleftarrow \text{Total amount payable}$$

Interest (I) = Total amount payable – principal amount

$$= 14{,}257.61 - 10{,}000 = Rs.\ 4{,}257.61$$

Eg 4 : An amount of money was invested on 01st January 2017 such that it would generate Rs.500,000/- at 31st December 2017. The interest rate on the particular investment is 13.2% per annum compounded monthly. Calculate the amount of the original investment and the corresponding interest earned during the year 2017.

S = 500,000,

r = 13.2 % (for 12 months) So, $r = \dfrac{13.2\ \%}{12\ months} \times 1\ month$ = 1.1 % (for 1month) = 1.1/100 = 0.011

n = 1 x 12 = 12 (In 1 year = 12 months)

$$S = P\,(1 + r)^n$$

$$500{,}000 = P\,(1 + 0.011)^{12} = P\,(1.011)^{12}$$

$$P = \frac{500{,}000}{(1.011)^{12}} = Rs.\ 438{,}486.41 \longleftarrow \text{Original Investment}$$

So, Interest earned = 500,000 – 438,486.41 = Rs. 61,513.59

Eg 5 : A person has borrowed Rs.140,000/- at an interest rate of 9% compounded annually. What is the total amount of money that should be repaid by him after 2 years?

$$S = P\,(1 + r)^n \qquad P = 140{,}000, \qquad n = 2, \qquad r = 9\ \% = 9/100 = 0.09$$

$$= 140{,}000\,(1 + 0.09)^2 = 140{,}000 \times 1.1881$$

$$= Rs.\ 166{,}334 \longleftarrow \text{Total amount payable}$$

REGULAR INVESTMENTS

There are Two Methods of regular investments.

(i.e) **Method 1 :** Deposits are made at the END of each year

$$S = \frac{A\,(R^n-1)}{(R-1)}$$

Method 2 : Deposits are made at the BEGINNING of each year

$$S = \frac{AR\,(R^n-1)}{(R-1)}$$

Where, S = the amount available at the end of n years
A = deposited amount at the end of / beginning of each year
R = r + 1 , r = rate of interest
n = Period (No. of years)

Eg 1 : A person deposits a certain amount of money at the end of each year to build a fund of Rs.100,000/- at the end of 4th year. Annual interest rate is 10 %. What is the amount that has to be deposited each year by him?

$$S = \frac{A\,(R^n-1)}{(R-1)} \qquad S = 100,000 \quad R = 1 + r = 1 + 10/100 = 1+0.1 = 1.1$$

$$100,000 = \frac{A\,[(1.1)^4-1]}{(1.1-1)}$$

$$= \frac{A\,[(1.1)^4-1]}{(1.1-1)}$$

$$= \frac{A\,[1.4641-1]}{(0.1)} = \frac{A\,[0.4641]}{(0.1)}$$

$$A = \frac{100,000 \times 0.1}{(0.4641)} = 21547.08$$

Eg 2 : Rs.12,000/- is deposited at the end of every year at the interest rate of 8 % per annum. Calculate the value of the amount at the end of 3 years?

$$S = \frac{A\,(R^n-1)}{(R-1)} \qquad A = 12,000 \quad R = 1 + r = 1 + 8/100 = 1+0.08 = 1.08$$

$$S = \frac{12000\,[(1.08)^3-1]}{(1.08-1)} = \frac{12000\,[1.259712-1]}{(0.08)}$$

$$= \frac{12000\,[0.259712]}{(0.08)} = 38,956.8$$

Eg 3 : A person deposits Rs.15,000/- in a savings account at the beginning of every year. If the annual interest rate of 7% is paid for this savings account, what is the balance of the savings account at the end of 5th year?

$$S = \frac{AR\,(R^n - 1)}{(R-1)} \qquad A = 15{,}000 \quad R = 1 + r = 1 + 7/100 = 1 + 0.07 = 1.07$$

$$S = \frac{15000 \times 1.07\,[(1.07)^5 - 1]}{(1.07 - 1)}$$

$$= \frac{16050\,[0.4025]}{(0.07)}$$

$$= 92{,}287.5$$

Eg 4 : A person deposits Rs.10,000/- to an account at the beginning of a particular year. From then he deposits Rs. 10,000/- at the beginning of every year for further period of 3 years. What is the total amount in the account at the end of 4 years? Consider interest rate as 10% per annum.

$$S = \frac{AR\,(R^n - 1)}{(R-1)} \qquad A = 10{,}000 \quad R = 1 + r = 1 + 10/100 = 1 + 0.1 = 1.01$$

$$S = \frac{10000 \times 1.01\,[(1.01)^4 - 1]}{(1.01 - 1)}$$

$$= \frac{10100\,[0.0406]}{(0.01)}$$

$$= 41{,}006$$

Eg 5 : A cricket team sets up a reserve fund for purchase of equipment can be replaced in exactly five years from now at an expected cost of Rs. 1,000,000 then. Calculate the amount that should be deposited into the fund at the beginning of each of the five years. Consider interest rate is 9 % per annum.

$$S = \frac{AR\,(R^n - 1)}{(R-1)} \qquad S = 1{,}000{,}000/- \qquad R = 1 + r = 1 + 9/100 = 1 + 0.09 = 1.09$$

$$1{,}000{,}000 = \frac{A \times 1.09\,[(1.09)^5 - 1]}{(1.09 - 1)}$$

$$A = \frac{1{,}000{,}000\,[0.09]}{1.09\,[(1.09)^5 - 1]}$$

$$A = \frac{90{,}000}{0.5871}$$

$$= 153{,}295.86$$

EXERCISES

01.   Rs.4,000,000/- is deposited into a bank account at an annual interest rate of 8% per annum. Calculate the difference in interest between compounded interest and simple interest at the end of 4 years?

FINDING COMPOUND INTEREST

$$S = P (1 + r)^n \qquad P = 4,000,000, \qquad n = 4, \qquad r = 8\% = 8/100 = 0.08$$

$$= 4,000,000 (1 + 0.08)^4 \quad = 4,000,000 \times 1.3605$$

$$= Rs.\ 5,442,000 \ \longleftarrow \ \text{Total amount payable}$$

Interest (I) = Total amount payable – principal amount

$$= 5,442,000 – 4,000,000 \quad = Rs.\ 1,442,000$$

FINDING SIMPLE INTEREST

$$I = Pnr \qquad P = 4,000000, \qquad n = 4, \qquad r = 8\% = 8/100 = 0.08$$

$$= 4,000,000 \times 4 \times 0.08$$

$$= Rs.\ 1,280,000$$

So, Difference between both interests   = Rs. 1,442,000 – Rs. 1,280,000

$$= Rs.\ 162,000$$

02.   A person has borrowed Rs.500,000/- from a Bank at an interest rate of 12% compounded annually. Calculate the total amount to be paid to settle the loan at the end of 2 years.

$$S = P (1 + r)^n \qquad P = 500,000, \qquad n = 2, \qquad r = 12\% = 12/100 = 0.12$$

$$= 500,000 (1 + 0.12)^2 \quad = 500,000 \times 1.2544$$

$$= Rs.\ 627,200 \ \longleftarrow \ \text{Total amount payable}$$

03.   A person has borrowed Rs.120,000/- at an interest rate of 8% per annum compounding once in a quarter. Compute the amount of interest that should be paid by him after 3 years.

$$S = P (1 + r)^n \qquad P = 120,000, \qquad n = 3 \times 4 = 12, \qquad r = 8/4 = 2\% = 2/100 = 0.02$$

$$S = 120,000 (1 + 0.02)^{12} \quad = 120,000 \times 1.2682$$

$$= Rs.\ 152,184 \ \longleftarrow \ \text{Total amount payable}$$

Interest (I) = Total amount payable – principal amount

$$= 152,184 – 120,000 \quad = Rs.\ 32,184$$

04. A person expects to receive the amount of Rs.750,000/- after 2 years and he deposit a certain amount to his savings account. He receives interest at the rate of 12% per annum compounded quarterly. Calculate the amount he should deposit to his savings account.

$S = P (1 + r)^n$ $S = 750,000$, $n = 2 \times 4 = 8$, $r = 12/4 = 3\% = 3/100 = 0.03$

$750,000 = P (1 + 0.03)^8$

$$P = \frac{750,000}{(1.03)8}$$

$P = 592,042.94$ ⟵ Amount he should deposit quarterly

05. Raja decides to build a fund of Rs.150,000/- to buy a land after 5 years. He expects to deposit a certain amount to his bank account at the end of every year. The bank provide 6 % interest for his deposits annually. Compute the amount he should deposit to his bank account.

$$S = \frac{A (R^n - 1)}{(R-1)}$$ $S = 150,000$ $n = 5$, $R = 1 + r = 1 + 6/100 = 1+0.06 = 1.06$

$$150,000 = \frac{A [(1.06)^5 - 1]}{(1.06 - 1)} = \frac{A [0.3382]}{(0.06)}$$

$$A = \frac{150,000 \times 0.06}{(0.3382)} = 26,611.47$$

06. A house has been let for 3 years at an annual rental of Rs. 480,000/-. This rental amount deposits in a bank account at an annual interest rate of 10%. The rental is paid at the end of each year. Calculate the total amount served at the bank by this rental.

$$S = \frac{A (R^n - 1)}{(R-1)}$$ $A = 480,000$, $n = 3$, $R = 1 + r = 1 + 10/100 = 1+0.1 = 1.1$

$$S = \frac{480,000 [(1.1)^3 - 1]}{(1.1 - 1)} = \frac{480,000 \times 0.331}{(0.1)}$$

$= $ Rs. 1,588,800

07. Nimal deposits Rs.100,000/- to an account at the beginning of every year for three years at the interest rate of 12% per annum. Calculate the total amount he should receive from this account after three years.

$$S = \frac{AR (R^n - 1)}{(R-1)}$$ $A = 100,000/-$ $R = 1 + r = 1 + 12/100 = 1+0.12 = 1.12$

$$S = \frac{100,000 \times 1.12 [(1.12)^3 - 1]}{(1.12 - 1)} = $$ Rs. 377,932.8