Simple Interest

1) Amount = Principal + Simple Interest

2) $SI = \frac{P \times R \times T}{100}$

3) $P = \frac{100 \times A}{100 + RT}$

4) $SI = \frac{ART}{100 + RT}$ (R → Rate of interest, A → Amount, T → Time, P → Principal, SI → Simple Interest)

5) If rate of interest is compounded-yearly

⇒ rate = $\left(\frac{R}{2}\right)$ % & time = 2T

(ii) quarterly ⇒ rate = $\left(\frac{R}{4}\right)$ % & time = 4T

(iii) monthly ⇒ rate = $\left(\frac{R}{12}\right)$ % & time = 12T

6. To calculate interest, the day on which amount is deposited, is not counted but the day on which amount is withdrawn is counted.

Problems

1) A sum of money becomes four times in 20 yr at SI. Find the rate of interest.

[Hint: If a sum of money becomes n times in T yr at SI, then formula for

Calculating rate of interest will be given as

$$R = \frac{100(n-1)}{T} \%$$

Sol: $T = 20$ yr, $n = 4$

$$R = \frac{100(n-1)}{T} = \frac{100(4-1)}{20} = \frac{100 \times 3}{20} = 15\%$$

2) A sum becomes two times in 5 yr at a certain rate of interest. Find the time in which the same amount will be 8 times at the same rate of interest.

[Hint: If a sum of money at a certain rate of interest becomes n times in T_1 yr and m times in T_2 yr, then formula for T_2 will be given as

$$T_2 = \left(\frac{m-1}{n-1}\right) \times T_1$$]

Sol:

$n = 2$, $m = 8$, $T_1 = 5$, $T_2 = ?$

$$T_2 = \left(\frac{m-1}{n-1}\right) \times T_1 = \left(\frac{8-1}{2-1}\right) \times 5 = 35 \text{ yr}.$$

3) In a certain time, a sum becomes 3 times at the rate of 5% per annum. At what rate of interest, the same sum becomes

6 times in same duration?

[Hint: If a sum of money in a certain time becomes n times at R_1 rate of interest and m times at R_2 rate of interest, then formula for R_2 will be given as $R_2 = \left(\frac{m-1}{n-1}\right) \times R_1$]

Soln:

$n = 3, m = 6; R_1 = 5\%, R_2 = ?$

$R_2 = \left(\frac{m-1}{n-1}\right) \times R_1 = \left(\frac{6-1}{3-1}\right) \times 5$

$= \frac{5}{2} \times 5 = \frac{25}{2} = 12.5\%$

4). A certain sum in certain time becomes ₹500 at the rate of 8% per annum SI and the same sum amounts to ₹200 at the rate of 2% per annum SI in the same duration. Find the sum and time.

[Hint: If a certain sum P in a certain time amounts to ₹A_1 at the rate of R_1% and the same sum amounts ₹A_2 at the rate of R_2%, then

$P = \left(\frac{A_2R_1 - A_1R_2}{R_1 - R_2}\right)$ and $T = \left(\frac{A_1 - A_2}{A_2R_1 - A_1R_2}\right) \times 100$]

Sol: $R_1 = 8\%$, $R_2 = 2\%$, $A_1 = ₹500$, $A_2 = ₹200$

$$P = \frac{A_2R_1 - A_1R_2}{R_1 - R_2} = \frac{(200\times8) - (500\times2)}{8-2}$$

$$= \frac{1600 - 1000}{6} = \frac{600}{6} = ₹100.$$

$$T = \frac{A_1 - A_2}{A_2R_1 - A_1R_2} \times 100$$

$$= \frac{500 - 200}{(200\times8) - (500\times2)} \times 100$$

$$= \frac{300}{600} \times 100 = 50\ yr.$$

5) A certain sum at a certain rate of SI amounts to ₹1125 in 4yr and ₹1200 in 7yr. Find the sum and rate of interest.

[Hint: If the rate of interest is uniform in above mentioned condition and time is variable, then $P = \left(\frac{A_2T_1 - A_1T_2}{T_1 - T_2}\right)$ and $R = \left(\frac{A_1 - A_2}{A_2T_1 - A_1T_2}\right) \times 100$]

Sol: $A_1 = ₹1125$, $A_2 = ₹1200$, $T_1 = 4yr$, $T_2 = 7yr$

$$P = \frac{A_2T_1 - A_1T_2}{T_1 - T_2} = \frac{(1200\times4) - (1125\times7)}{4-7}$$

$$= \frac{4800 - 7875}{-3} = \frac{-3075}{-3} = ₹1025.$$

$$R = \frac{A_1 - A_2}{A_2 T_1 - A_1 T_2} \times 100$$

$$= \frac{(1125 - 1200)}{(1200 \times 4) - (1125 \times 7)} \times 100$$

$$= \frac{-7500}{4800 - 7875} = \frac{-7500}{-3075}$$

$$R = 2.43\ \%$$

Compound Interest

1) Compound Interest = Amount − Principal

2) Difference between CI & SI

(i) for 2 yr $= P\left(\frac{R}{100}\right)^2 = \frac{SI \times R}{200}$

(ii) for 3 yr $= P\left(\frac{R}{100}\right)^2 \left(\frac{R}{100} + 3\right)$

3) If simple interest for a certain sum for 2yr at the annual rate of interest R% is SI, then $CI = SI\left(1 + \frac{R}{200}\right)$. (it is applicable only for 2yr)

4) If a certain sum at Compound interest becomes x times in n_1 yr and y-times in n_2 yr, then

$$x^{1/n_1} = y^{1/n_2}.$$

5) If a certain sum at CI becomes A_1 in n yr and A_2 in $(n+1)$ yr, then

(i) Rate of ~~interest~~ CI $= \frac{(A_2 - A_1)}{A_1} \times 100\%$.

(ii) Sum $= A_1 \left(\frac{A_1}{A_2}\right)^n$

6) If the population of a city is P and it increases with the rate of $R\%$ per annum, then (i) population after n yr $= P\left(1 + \frac{R}{100}\right)^n$

(ii) Population n yr ago $= \frac{P}{\left(1 + \frac{R}{100}\right)^n}$.

1) The difference between CI and SI for 2 yr at rate of 5% per annum is ₹5, then find the Sum.

[Hint : Use formula no. 2(i)]

Sol: Difference (D) = ₹5, rate (R) = 5%.

$D = P\left(\frac{R}{100}\right)^2$.

$5 = P\left(\frac{5}{100}\right)^2$.

$5 = \frac{P \times 5 \times 5}{100 \times 100} \Rightarrow P = ₹2000$.

2) The difference between CI and SI for 3 yrs at the rate of 20% pa is ₹152. What is the principal sent?
[Hint: use formula no 2(ii)]

Sol: Difference b/w CI and SI for 3yr = ₹152.

$$P\left(\frac{R}{100}\right)^2\left(\frac{R}{100}+3\right) = 152$$

$$P\left(\frac{20}{100}\right)^2\left(\frac{20}{100}+3\right) = 152$$

$$P\left(\frac{1}{25}\right)\left(\frac{16}{5}\right) = 152$$

$$P = \frac{152 \times 25 \times 5}{16}$$

$$= 9.5 \times 25 \times 5$$

$$P = ₹1187.5$$

3) If a certain sum at CI becomes double in 5 yr, then in how many years, it will be 16 times at the same rate of interest?
[Hint: Use formula No: 4]

Sol: If Sum = x, then
x becomes 2x in 5 yr
2x becomes 4x in 10 yr
4x becomes 8x in 15 yr

$8x$ becomes $16x$ in 20 yr.

$n_1 = 5$ yr, $x = 2$, $y = 16$ & $n_2 = ?$

$$x^{1/n_1} = y^{1/n_2}$$

$$2^{1/5} = 16^{1/n_2}$$

$$2^{1/5} = 2^{4 \times 1/n_2}$$

$$\Rightarrow \frac{1}{5} = \frac{4}{n_2}$$

$$\Rightarrow n_2 = 5 \times 4 = 20 \text{ yr.}$$

4) A sum of money invested at CI amounts to ₹800 in 2yr and ₹840 in 3yr. Find the rate of interest per annum and the sum.
[Hint: use formula no. 5]

Sol: $A_1 = ₹800$, $A_2 = ₹840$

Rate of CI $= \frac{(A_2 - A_1)}{A_1} \times 100\%$

$= \frac{(840 - 800)}{800} \times 100\%$

$= \frac{40}{8}\% = 5\%$

$$\text{Sum} = A_1 \left(\frac{A_1}{A_2}\right)^n = 800 \times \left(\frac{800}{840}\right)^2 =$$

$$= \frac{800 \times 800}{840} \times \frac{800}{840} = \frac{320000}{441} = ₹725.62$$