SIMPLE INTEREST

So students hope you are doing good your studies

In last two study notes we have discussed about percentage and profit and loss. This week its turn of simple interest.

So lets start

What is Simple Interest?

Friends what happen if you borrow some money from bank or anybody??

Usually he ask more in return than what we actually taken. This is called interest.

If a person × borrows some money from another person Y for a certain period, then after that specified period, × (borrower) has to return the borrowed money with some additional money. This additional money that × (borrower) has to pay is called **Interest**. The actual borrowed money is called **Principal** or **Sum**. The Principle and interest together is called **amount**, and the time for which × the borrower has been used the borrowed money is called the **time**. The interest that × has to pay for every 100 rupees each year is called **rate percent per annum.**

If the interest on a sum borrowed for a certain period is reckoned uniformly, then it is called **Simple Interest** and it is denoted by **S.I.**

Simple interest can be simply defined as the interest that is paid only on the principal amount. Unlike compound interest, simple interest does not consider "interest on interest" concept and the value is obtained by multiplying the interest rate by the principal amount and the number of days that elapse between payments.

So,

$$Simple\ Interest\ (SI) = \frac{P \times R \times T}{100}$$

Where:

P: Principal (original amount)

R: Rate of Interest (in %)

T: Time period (yearly, half-yearly etc.)

Amount Due at the end of the time period, A = P (original amount) + SI

$$A = P + \left\{ \frac{P \times R \times T}{100} \right\}$$

If you have a close look, Simple Interest is nothing else but an application of the concept of percentages.

To be able to solve S.I questions easily, one has to get acquainted with certain terms and definitions. Some of such important terms are mentioned below.

Note- Generally if C.I. is not mention, then we assume S.I.

Definition of related terms-

Principal (P): The original sum of money loaned/deposited. Also known as capital.

Terms Related to Simple Interest

- **Principal :**

  Principal (sum) can be defined as the cash obtained or loaned out for a specific period. In other terms, it can be defined as the face value of a debt security or the original investment amount. It is indicated by P.

- **Amount:**

  An amount (A) is just the sum of the principal amount and the interest of a loan. This is the total amount that is due at the end of a loan period.

Amount = P + S.I.

=> **A = P + (P × I × T / 100)**

Time and Rate of Interest:

Time period (T) is simply the term for which cash is deposited or borrowed. This can be either quarterly, half yearly, annually, etc. The rate of interest (R or I) is that percent of interest that one pays for the borrowed money or earns from the deposited money.

- **Interest (I):** The amount of money that you pay to borrow **Time (T):** The duration for which the money is borrowed/deposited.
- **Rate of Interest (R):** The percent of interest that you pay for money borrowed, or earn for money deposited

Q.1. What would be the simple interest on Rs. 5000 after 5 years if the rate of interest is 10% per annum?

Solution:

In this question, the principal amount is given as Rs. 5000, the time period is 5 years and the rate of interest is 10% per annum.

The basic formula for Simple interest is = P × I × T / 100.

=> S.I. = 5000 × 10 × 5 / 100

= Rs. 2500.

Q.2. How much would a person repay after 5 years if he borrowed Rs. 15000 at the rate of 25% per annum?

Solution:

By repayment, it can be understood that the "amount" has to be calculated. In this problem, following are the available data:

Principal = Rs. 15000

Interest Rate = 25%

Time Period = 5 years

So, S.I. =15000 × 25 × 5 /100

=> S.I. = 18750.

Now, Amount = P + S.I.

So, Repayment Amount (A) = 15000 + 18750

= 33750.

Simple Interest

S.I.=PRT/100

Where

S.I.=Simple interest

T= Time

R=Rate percentage

Concept 1.

S.I. on a certain sum is n times of principal find R% or T, if both are equal numerically

Given S.I. =nP

$$R = T = \sqrt{(n \times 100)}$$

Concept 2.

At what R% p.a., will a sum of money becomes n times in T years

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

Concept 3.

A certain sum, becomes m times in T years and n times in how many years

$$\text{Required Time} = \frac{(n-1) \times T}{(m-1)}$$

Note-

Generally if C.I. is not mention, then we assume S.I.

Concept 4.

If a certain sum in T1 years is A1 on S.I and in T2 years on S.I is A2 .

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

$$P = \frac{T_1 A_2 - T_2 A_1}{T_1 - T_2}$$

Eg. **A sum of money become 756 in 2 yr& 875 in 3(1/2) yr. find R% and S.I.**

P+2 S.I.=756……..(i)

P+3.5 S.I.=875

R%=[(875-756)×100]/[2×875-3.5×756]=13%

Also find the S.I. by solving eq (i)

1.5 S.I. =117

S.I.=78 Rs.

Concept 5.

The annual payment not will discharge a debt of Rs.A, due in T years at R% P.A., On S.I.

Annual Payment= $\frac{200A}{T\{200 + R(T-1)\}}$

Eg. **What annual payment discharge a debt of Rs. 12900, due in 4 yrs. At 5% rate**

A.P.=(200×12900)/[4(200+5×3)]=3000 Ans

Alternative

100+105+110+115=12900

430=12900

100=12900/(430)×100=3000

Concept 6.

(i) If the Amount are same i.e.A1=A2=A3=…….An, after T1, T2, T3……Tn years,

The ratio of Principal

P1: P2:P3……Pn=

$$\frac{1}{100+R_1T_1}:\frac{1}{100+R_2T_2}:\frac{1}{100+R_3T_3}$$ and so on

(ii) If S.I. are same after T1, T2, T3……

In years the ratio

P1 : P2: P3……..Pn=

$$\frac{1}{R_1T_1}:\frac{1}{R_2T_2}:\frac{1}{R_3T_3}$$ and so on

Eg. A Sum of Rs. 2600, is lent out in two parts S.I. at 10% for 5 yr is equal to S.I. on 2nd part at 9% rate for 6 yr. find the ratio of parts.

Solution :

Given SI1 = SI 2

P1 : P2 = 1/R1T1 : 1/R2T2

= 1/(10×5) : 1/(9:6)

27:25

Basic Problem 1: What is the SI on Rs. 7500/- at the rate of 12% per annum for 8 years?

Using the Basic Formula:

Simple Interest (SI) = (P × R × T)/100

P – Principal amount, T- Number of years, R – Rate of Interest

Given P = 7500, T = 8 Years, R = 12%

Simple Interest (S.I.) = (7500×12×8)/100

Simple Interest (S.I.) = 7200

Q.3. An amount becomes 4 times in 15 years at a simple rate of interest. Find the rate of interest.

Solution using short trick:

Lets assume principal amount = 100%

This amount becomes 4 times in 15 years.

Hence the compound amount in 15 years = 4 × 100 = 400%

As we know that,

Compound amount = Principal amount + Interest

400% = 100% + Interest

We get, Interest = 300%

300% interest levied in 15 years. Therefore,

Interest levied in 1 year = 300/15 = 20%

Rate of interest is 20% per annum which is a required answer.

Basic Problem 2: A man borrowed Rs 15000/- at the rate of 24% SI and to clear the debt after 6years, much he has to return:

Using the Basic Formula:

Simple Interest (SI) = (P × R × T)/100

P – Principal amount, T- Number of years, R – Rate of Interest

Given P = 15000, T = 6 Years, R = 24%

Simple Interest (S.I.) = (15000×24×6)/100= Rs 21600

Therefore, total interest = 21600

Total repayment = S.I + Principal amount = 21600 + 15000 = Rs 36600

Example 1: A sum of money at simple interest amounts to Rs. 850 in 3 years and to Rs. 900 in 4years. The sum is:

(a) Rs. 650 (b) Rs. 690

(c) Rs. 725 (d) Rs. 700

Answer : (d)

S.I. for 1 year = 900 – 850 = Rs 50

S.I. for 3 years = 50 × 3 = Rs 150

Original Amount/ Principal = 850 – 150 = Rs 700

Example 2: Maninder invested into two different schemes, P and Q at simple interest rate,an amount of Rs. 15,000. Rate of interest for scheme P & Q were 14% p.a. and 18% p.a. respectively. If the total amount of simple interest earned in 2 years be Rs. 5000, what was the amount invested in Scheme P?

(a) Rs. 5000 (b) Rs. 6500

(c) Rs. 7200 (d) Rs. 7500

Let the sum invested in Scheme P be Rs. x and that in Scheme Q be Rs. (15000 – x).

Then, {x × 14 × 2}/100 + {(15000 – x) × 18 × 2}/100

= 5000

28×+540000-36×=500000

8x=40000

x=5000

Hence, money deposited in scheme P = Rs 5000.

Q.4. A sum of Rs. 15,000 amounts to Rs. 19,500 in 5 years at the rate of simple interest. Whatis the rate of interest?

(a) 3% (b) 4%

(c) 5% (d) 6%

Here P = Rs. 15000 and Amount = Rs. 19500

Hence S.I. = Rs. 19500–Rs. 15000 = Rs. 4500.

We know: Simple Interest (SI) = (P × R × T)/100

P – Principal amount, T- Number of years, R – Rate of Interest

Therefore, 4500 = (15000×R×5)/100

R = 6%

Question 4: How much time will it take for an amount of Rs. 900to yield Rs. 81 as interest at 2.25%per annum of simple interest?

(a) 3 years (b) 4 years

(c) 5 years (d) 6 years

We know: Simple Interest (SI) = (P × R × T)/100

P – Principal amount, T- Number of years, R – Rate of Interest

Therefore: 81 = (900×2.25×T)/100

T = 4 years

Q.5. A money-lender claims he lends money at simple rate of interest of 10% per annum. But he cleverly tricks the farmers by including the interest amount in the principal when he calculates it every six months. The effective annual rate of interest he is charging is:

(a) 10% (b) 10.25%

(c) 10.5% (d) 10.75%

Let the sum be Rs 100.

Then,

S.I. for first six months = Rs. (100 × 10 × 1)/(100×2)= Rs. 5

Increased principal for the last six months= Rs. 105

SI for the last six months = Rs. (105 × 10 × 1)/ (100×2)

SI = Rs. 5.25

Netinterest charged in an year = Rs. 10.25

Hence, effective rate of interest

= (10.25/100) × 100 = 10.25%.

Simple Interest Tips

If the interest on a sum of money is 1/× of the principal, and the number of years is equal to the rate of interest then rate can be calculated using the formula: $\sqrt{}$(100/×)

Derivation for this result:

We Know SI = {(P × R × T)/100}

Put SI = P/x ; and T=R

P/× = {(P × R × T)/100}

$R^2 = 100/x$

$R = \sqrt{(100/x)}$

Example : The interest on a sum of money is 1/16 of the principal, and the number of years is equal to the rate of interest. What is the rate percent?

Solution :

Using the above concept :

$R = \sqrt{(100/x)}$

$R = \sqrt{(100/16)}$

$R = 5/2\%$

Simple Interest Tips

Change in Simple Interest when time changes from T_1 to T_2 is given by the formula:

$$(SI_1) - (SI_2) = \frac{(P \times R \times (T_1 - T_2))}{100}$$

Change in Simple Interest when principal changes from P_1 to P_2 is given by the formula:

$$(SI_1) - (SI_2) = \frac{(T \times R \times (P_1 - P_2))}{100}$$

Change in Simple Interest When rate of interest changes from $r_1$to r_2 is given by the formula:

$$(SI_1) - (SI_2) = \frac{(T \times P \times (r_1 - r_2))}{100}$$

Example: Simple interest on Rs 200 increases by Rs 50 when time increases by 5 years. Find rate percent per annum.

$$Simple\ Interest\ (SI_1) = \frac{(P \times R \times T_1)}{100}$$

$$Simple\ Interest\ (SI_2) = \frac{(P \times R \times T_2)}{100}$$

$$(SI_1) - (SI_2) = \frac{(P \times R \times (T_1 - T_2))}{100} \quad \text{(or use it directly)}$$

$$50 = \frac{200 \times R \times 5}{100}$$

$\Rightarrow R = 5\%$

Example: If the SI on Rs 1000 be more than the interest on 2000 by Rs 20 in 4 years, find the rate per annum.

Solution: When principal changes from $P_1$to P_2

$$(SI_1) - (SI_2) = \frac{(T \times R \times (P_1 - P_2))}{100}$$

$$20 = \frac{4 \times r \times (2000 - 1000)}{100} = 0.5\%$$

Simple Interest Tips

The rate of interest for t_1 years is $r_1\%$, t_2 years is $r_1\%$, t_2 years is r_3 %.If a man gets interest of Rs x for ($t_1 + t_2 + t_3 = n$) years, then principal is given by

$$\frac{x \times 100}{r_1 t_1 + r_2 t_2 + r_3 t_3}$$

Derivation for this result:

$$We\ have\ SI = \frac{P \times R \times S}{100}$$

$$x \times 100 = p[t_1 r_1 + t_2 r_2 + t_3 r_3]$$

$$P = \frac{x \times 100}{[t_1 r_1 + t_2 r_2 + t_3 r_3]}$$

Example: The rate of interest for 3 years is 4%, 5years is 6%,1 years is 5%. If a man gets interest of Rs. 4700 for 9 years, calculate the principal amount?

Solution:

$$\text{Here } P = \frac{x \times 100}{[t_1 r_1 + t_2 r_2 + t_3 r_3]}$$

$$\Rightarrow P = \frac{4700 \times 100}{3 \times 4 + 5 \times 6 + 1 \times 5} = Rs\,10000$$

Simple Interest Tips

If a person deposits A_1 amount at r_1% per annum and amount A_2 at r_2% per annum, then the rate of interest for the whole sum is $\{(A_1r_1 + A_2r_2)/(A_1+A_2)\}$

Example: A man deposits Rs.1000 at 4% per annum and Rs 2000 at 5% per annum, find the rate of interest for the whole sum.

Solution:

Method-1:

Using the formula for, Simple Interest (SI) = {(P × R × T)/100}

x = {(1000 × 4 × 1)/100} = 40

Y = (2000 × 5 × 1)/100 = 100

Total interest = 100+40=Rs. 140

Total principal =1000+2000=Rs.3000

Using the formula:

140 = {(3000 × R × 1)/100}

R = 14/3%

Method-2:

Applying above concept $\{(A_1r_1 + A_2r_2)/(A_1+A_2)\}$, the rate of interest is

[{(1000 × 4) + (2000 × 5)}/(1000 + 2000)]

= 14000/3000

14/3%

Question 2: The sum of interest on a sum of money is 1/36 of the principal, and the number of years is equal to the rate of interest. What will be the rate percent?

(a) 5/3% (b) 4/3%

(c) 7/3% (d) 8/3%

Answer: (a)

$$\text{Use above concept } R = \sqrt{\frac{100}{x}}$$

$$R = \sqrt{\frac{100}{36}}$$

$$R = \frac{10}{6} = 1\frac{2}{3}\%$$

Question 2: If the SI on Rs 1000 be more than the interest on 800 by Rs 80 in 4 years, find the rate per annum.

(a) 12.5% (b) 10%

(c) 7.5% (d) 7%

$$(SI_1) - (SI_2) = \frac{(T \times R \times (P_1 - P_2))}{100}$$

$$80 = \frac{4 \times r \times (1000 - 800)}{100} = 10\%$$

Q.6. A sum was put at SI at a certain rate for 4 years. If the sum would have put at a 2% higher rate, it could yield Rs 800 more. What will be the principal?

(a) 14000 (b) 12000

(c) 13000 (d) 10000

Answer: (d)

Use the following formula:

$$P = \frac{X \times 100}{n \times r}$$

$$P = \frac{800 \times 100}{4 \times 2} = Rs\ 10000$$

Q.7. A sum of money becomes 3 times in 25 years. Calculate the rate of interest.

(a) 8% (b) 10%

(c) 12% (d) 13%

Answer: (a)

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

$$R = \frac{100(3-1)}{25} = 8\%$$

Q.8. The rate of interest for 2 years is 3%, 4 years is 6%,2 years is 4%.If a man gets interest of Rs. 3800 for 9 years, Calculate the principal amount.

(a) 14000 (b) 10000

(c) 13000 (d) 15000

Answer: (b)

$$P = \frac{x \times 100}{[t_1 r_1 + t_2 r_2 + t_3 r_3]}$$

$$\Rightarrow P = \frac{3800 \times 100}{2 \times 3 + 4 \times 6 + 2 \times 4} = Rs\,10000$$

Concept of installment-

Suppose you have to buy a car at Rs. 200000. You can pay the seller in two ways: Either you can pay the entire amount in one go i.e. you'll pay Rs. 200000 and take the car.

But what if you don't have enough money at the time of purchase?

The other option is that you pay some down-payment and give the remaining amount in the form of equal installments at regular intervals.

Note: In installment scheme the buyer pays more because in addition to installment a buyer has to pay an interest on it monthly or yearly.

What is Down payment?

It is the amount that is paid initially while buying the article. Rest is paid in form of installment and an interest on it.

Installments Paid With Simple Interest

There are two types of problems asked from this concept.

Type 1:

If the total loan is taken for 4 months, then situation will be something like this:-

At the end of first month: Interest for next 3 months will be paid

At the end of second month: Interest for next 2 months will be paid

At the end of third month: Interest for next 1 month will be paid

At the end of Forth month: No Interest will be paid

So, if × denotes installment variable, R for rate % per annum, t for time, then every month

Amount to be paid= x + amount of interest

The table will look like this.

At the end of First month	Interest for next 3 months will be paid	$x+\frac{x\times(t-1)\times R}{100\times12}$
At the end of second month	Interest for next 2 months will be paid	$x+\frac{x\times(t-2)\times R}{100\times12}$
At the end of third month	Interest for next 1 months will be paid	$x+\frac{x\times(t-3)\times R}{100\times12}$
At the end of Forth month	No Interest will be paid	x

$$=p+\frac{p\times t\times R}{100\times12}$$

We can write this process in the form of equation

$$p+\frac{p\times t\times R}{100\times12}=x+\frac{x\times(t-1)\times R}{100\times12}+x+\frac{x\times(t-2)\times R}{100\times12}+x+\frac{x\times(t-3)\times R}{100\times12}+x$$

Q.9. If an amount becomes Rs. 1950 in 6 years at 5% annual rate of interest then how much the amount will be in 8 years at the same rate of interest?

Solution using short trick:

Given that,

Compound amount after 6 years = 1950

Lets assume the principal amount as 100%

Rate of interest = 5% per year

So, the total interest levied in 6 years will be

= 5×6 = 30%

Similarly total interest levied in 8 years will be

= 5×8 = 40%

As we know that,

Compound Amount = Principal Amount + Interest

Therefore,

1950 = 100% + 30%

1950 = 130%

therefore, 1% = 1950/130

therefore, 140%= (1950/130) × 140

On Solving we get,

140% = Rs. 2100

So, the compound amount after 8 years = 100%+40%

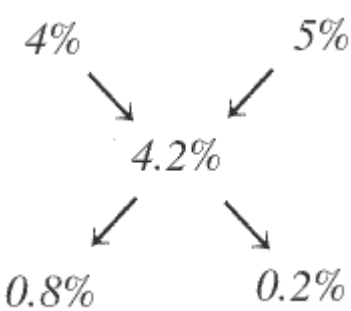
=140% = Rs.2100

Rs. 2100 is the amount after 8 years which is the required answer.

Solution using short trick:

We can solve these type of questions by using mi×tures and composition topic's concept.

Step 1: We write the values in a Cross Symbol Form. Both the initial interests values are kept at the top ends of cross and final value of interest the center of cross symbol. Differences of initial and final values in kept the bottom ends of cross. See as given below.



Step 2: Find the ratio between the values which are at the bottom of cross. In our case it is,

0.8 : 0.2 = 4 : 1

Hence the 4 part of Rs. 5000 is lent on 4% rate while 1 part of Rs. 5000 is lent on 5% rate.

Step 3: Make 5 parts of given amount. In our case we will get each part equals to Rs. 1000.

Hence Money lent of 4% rate

= 4 parts = 4 × 1000 = Rs. 4000

So the amount of Rs. 4000 is lent on the interest rate of 4% which is a required answer.

Q.10. How much a person should pay per year to payment the debt of Rs 4180 due in 4 years at the rate of 3% per annum?

(a) 1400 (b) 1000

(c) 1300 (d) 1500

Answer: (b)

$$\text{Installment each year} = \frac{100A}{100t + \frac{rt(t-1)}{2}}$$

Put the values

$$\frac{100 \times 4180}{400 + 18} = \frac{100 \times 4180}{418} = Rs\,1000$$