

Simple Interest

Concept of Simple Interest

Sometimes, we need a large amount of money for bigger purposes such as buying a house, buying a car, paying fee for higher education etc. If we do not readily have that much of money then we have to borrow it from money lenders, banks or co-operative credit societies for a particular period of time along with a condition of paying some extra money at a particular rate. This borrowed money is called **loan**.

For example, Jatin borrowed Rs 10000 from Shashank. He promised to give him back Rs 11000 after one year.



Here, Rs 10000 is loan taken by Jatin from Shashank.

Now, the question is that why did Jatin promise to pay more money than he borrowed?

Have you heard about interest? Let us suppose that someone borrows some money for a specific time period. Then, the borrower has to pay some extra money along with the original amount after the passage of that fixed time period. This extra money that is paid by the borrower is called **interest**.

In the given example, extra money paid = Rs $(11000 - 10000)$ = Rs 1000

Thus, here, he paid Rs 1000 as the interest for one year.

The original amount of money borrowed is called **principal**. In this case, Rs 10000 is the principal.

The total amount that has to be paid back after the specific time period is called **amount**. In the above example, Rs 11000 is the amount.

Thus, we can conclude that

Amount = Principal + Interest

Interest = Amount – Principal

Principal = Amount – Interest

The interest is always calculated on the principal and is given in the form of percentage for a certain period of time. This percentage is known as the rate of interest.

Let us now calculate the rate of interest for the above example.

Principal = Money borrowed by Jatin for one year = Rs 10000

Amount = Money returned by Jatin after one year = Rs 11000

Interest = Extra money given by Jatin = Rs (11000 – 10000) = Rs 1000

Now, to express the rate of interest, we need to calculate the interest per Rs 100 as principal.

Interest on Rs 10000 in one year = Rs 1000

Interest on Re 1 in one year = $\frac{\text{Rs } 1000}{\text{Rs } 10000}$

Therefore, interest per Rs 100 in one year = $\frac{\text{Rs } 1000}{\text{Rs } 10000} \times \text{Rs } 100 = \text{Rs } 10$

Thus, the rate of interest is 10% per year, which can also be expressed as 10% p.a. (per annum).

Now, how will you calculate the interest applicable on Rs 7000, at the rate of 12% p.a., at the end of one year?

Rate of interest = 12% p.a.

This means, if Rs 100 is borrowed, then interest after one year = Rs 12

Thus, if Re 1 is borrowed, then interest after 1 year = $\frac{\text{Rs } 12}{\text{Rs } 100} = \frac{12}{100}$

And, if Rs 7000 is borrowed, then interest after 1 year = $\frac{12}{100} \times (\text{Rs } 7000) = \text{Rs } 840$

Thus, the interest on Rs 7000 at the end of one year = Rs 840

Now, what is the amount?

Amount = Principal + Interest = Rs 7000 + Rs 840 = Rs 7840

Therefore, from the above example, it is clear that

$$\text{Interest} = \text{Rate of interest} \times \text{Principal}$$

If we express interest as I , principal as P , and rate of interest as $R\%$, then the above statement can be expressed as follows:

$$I = P\% \text{ of } R = \frac{P}{100} \times R = \frac{PR}{100}$$

Now, if the amount is expressed as A , then $A = P + I$

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

Remember:

1. Interest = $I = \frac{PR}{100}$

2. Amount = $A = P \left(1 + \frac{R}{100} \right)$

Note that the above formulae are applicable only in cases where **the money has to be returned after 1 year, i.e., the time period is 1 year.**

These formulae are not applicable if the time period is, say, 1 month, 2 months, 3 months, etc, or it is 2 years, 3 years, etc.

Let us apply the above formulae in an example.

What amount is to be paid at the end of one year for Rs 10000 at the rate of 10% p.a.?

Principal = P = Rs 10000

Rate of interest = R = 10%

Thus, amount payable at the end of one year = $A = P \left(1 + \frac{R}{100} \right)$

$$\begin{aligned} &= 10000 \left(1 + \frac{10}{100} \right) \\ &= 10000 \left(\frac{100 + 10}{100} \right) \\ &= 10000 \times \frac{110}{100} \\ &= 11000 \end{aligned}$$

Therefore, amount payable at the end of one year = Rs 11000

Let us go through some examples to understand the concepts of simple interest better.

Example 1:

Rahul borrowed some money from Parul. In return, Rahul had to pay Rs 350 as interest, along with the actual sum. If he paid a total of Rs 4850 to Parul, then find the amount that he borrowed.

Solution:

Interest = Rs 350

Amount = Rs 4850

$\therefore$ Principal = Amount – Interest = Rs 4850 – Rs 350 = Rs 4500

Thus, Rahul borrowed Rs 4500 from Parul.

Example 2:

What will be the interest on Rs 8700 at the end of one year at the rate of 20% per year? Also find the amount payable at the end of the year.

Solution:

Principal (P) = Rs 8700

Rate of interest (R) = 20%

Time period (T) = 1 year

$$\therefore I = \frac{P \times R \times T}{100} = \text{Rs } \frac{8700 \times 20 \times 1}{100} = \text{Rs } \frac{174000}{100} = \text{Rs } 1740$$

Therefore, interest (I) payable at the end of the year = Rs 1740

Now, amount (A) payable at the end of the year = $P + I$

= Rs 8700 + Rs 1740

= Rs 10440

Example 3:

To buy a car, Jitendra borrowed a sum of Rs 200000 for 12 years at the rate of 4% p.a. What is the total amount that he has to pay to repay the loan?

Solution:

Principal (P) = Rs 200000

Rate of interest (R) = 4%

Time period (T) = 12 years

Now, amount (A) payable at the end of the time period $= P \left(1 + \frac{R \times T}{100} \right)$

$$= 200000 \left(1 + \frac{4 \times 12}{100} \right)$$

$$= 200000 \left(\frac{100 + 48}{100} \right)$$

$$= 200000 \times \frac{148}{100}$$

$$= 296000$$

Therefore, Jitendra has to pay Rs 296000 in order to repay his loan.

Example 4:

Kiran invested a sum of Rs 15000 for 4 years and received a total amount of Rs 18000 at the end of this time period. Find the applicable rate of interest.

Solution:

Principal (P) = Rs 15000

Time period (T) = 4 years

Amount (A) = Rs 18000

$\therefore$ Interest = $A - P$ = Rs 18000 – Rs 15000 = Rs 3000

Let the rate of interest be $R\%$ p.a.

$$\text{We know that } A = P + \frac{P \times R \times T}{100}$$

$$\Rightarrow 18000 = 15000 + \frac{15000 \times R \times 4}{100}$$

$$\Rightarrow 15000 + \frac{15000 \times R \times 4}{100} = 18000$$

$$\Rightarrow \frac{15000 \times R \times 4}{100} = 18000 - 15000$$

$$\Rightarrow \frac{15000 \times R \times 4}{100} = 3000$$

$$\Rightarrow 15000 \times R \times 4 = 3000 \times 100$$

$$\Rightarrow R = \frac{300000}{15000 \times 4} = 5$$

Therefore, the applicable rate of interest is 5% p.a.

Example 5:

Mr. Sharma borrowed some money from Mr. Gupta for $\frac{3}{2}$ years at the rate of 11% per annum. Also, he borrowed the same amount of money from Mr. Verma for same time period at the rate of 12% per annum. If Mr. Sharma had to pay Rs 6210 as total interest to repay the whole debt then what was the total money that he borrowed?

Solution:

Case I: Money borrowed from Mr. Gupta

Time period (T) = $\frac{3}{2}$ years

Rate (R) = 11% per annum

Let principal be P and interest be I_1 .

$$\begin{aligned} I_1 &= \frac{P \times R \times T}{100} \\ \Rightarrow I_1 &= \frac{P \times 11 \times 3}{100 \times 2} \\ \Rightarrow I_1 &= \frac{33P}{200} \end{aligned}$$

Case II: Money borrowed from Mr. Verma

Time period (T) = $\frac{3}{2}$ years

Rate (R) = 12% per annum

Principal = P

Let interest be I_2 .

$$\begin{aligned} I_2 &= \frac{P \times R \times T}{100} \\ \Rightarrow I_2 &= \frac{P \times 12 \times 3}{100 \times 2} \\ \Rightarrow I_2 &= \frac{36P}{200} \end{aligned}$$

Total interest = Rs 6210

$$\therefore I_1 + I_2 = \text{Rs } 6210$$

$$\begin{aligned} \frac{33P}{200} + \frac{36P}{200} &= \text{Rs } 6210 \\ \Rightarrow \frac{69P}{200} &= \text{Rs } 6210 \\ \Rightarrow P &= \text{Rs } \frac{6210 \times 200}{69} \\ \Rightarrow P &= \text{Rs } 18000 \end{aligned}$$

Thus, Mr. Sharma borrowed Rs 18000 from Mr. Gupta and the same amount from Mr. Verma.

Therefore, the total money borrowed by Mr. Sharma = Rs 18000 + Rs 18000 = Rs 36000

Example 6:

Surya deposited Rs 25000 in the bank at the rate of 8% per annum. After how much time the money will get doubled?

Solution:

Principal (P) = Rs 25000

Amount (A) = $2P$ = Rs (2×25000) = Rs 50000

Interest = $A - P$ = Rs 50000 – Rs 25000 = Rs 25000

Rate (R) = 8%

$$\begin{aligned} I &= \frac{P \times R \times T}{100} \\ \Rightarrow 25000 &= \frac{25000 \times 8 \times T}{100} \\ \Rightarrow T &= \frac{100}{8} \\ \Rightarrow T &= 12.5 \end{aligned}$$

Thus, after 12 years and 6 months, the money will get doubled.