

INTEREST

(Simple Interest)

11.1 BASIC CONCEPT

Sometimes, when in need, we borrow money. This money could be borrowed from a bank or a money lender. While returning this money after using it for a certain time (period), we pay some additional money with the sum (money) borrowed.

This additional money that is paid for having used the money borrowed is called **Interest**.

The money we borrow is called **Principal** or **Sum** and the total money we return is called **Amount**, such that :

$$\text{Amount} = \text{Principal} + \text{Interest} \text{ i.e. } A = P + I$$

Rate Percent (R) :

It is the *interest* on ₹ 100 for a specific period of time (in general, for one year).

Examples:

1. Rate of interest is 6% per annum means ₹ 6 is the interest on ₹ 100 for one year.
2. Rate of interest is 1% per month means ₹ 1 is the interest on ₹ 100 for one month.

$$\begin{aligned} \text{Also, rate of interest} &= 1\% \text{ per month} \\ &= 1\% \times 12 \text{ months} = 12\% \text{ per annum (per year)} \end{aligned}$$

3. In the same way, if the rate of interest semi-annually is 4%, ₹ 4 is the interest on ₹ 100 for half-a-year, i.e. for six months

$$\begin{aligned} \text{Also, rate of interest} &= 4\% \text{ semi-annually} \\ &= 2 \times 4\% \text{ annually} = 8\% \text{ per annum} \end{aligned}$$

Time (T) :

It is the *period* for which the money is borrowed (taken) or lent (given).

11.2 CALCULATING INTEREST

The value of interest depends on three factors :

- (i) Principal (P) (ii) Rate of Interest (R) (iii) Time (T)

And it is calculated by using the formula :

$$\text{Interest} = \frac{\text{Principal} \times \text{Rate} \times \text{Time}}{100} \text{ i.e. } I = \frac{P \times R \times T}{100}$$

Interest and
simple interest
mean the
same.

Example 1 :

Find the interest on ₹ 800 for 3 years at 9% per annum.

Solution :

Here, Principal (P) = ₹ 800, Rate (R) = 9% and Time (T) = 3 years.

$$\therefore \text{Interest} = \frac{P \times R \times T}{100} = \frac{\text{₹ } 800 \times 9 \times 3}{100} = \text{₹ } 216 \quad (\text{Ans.})$$

Example 2 :

Find the simple interest on ₹ 2,500 at 1.5% per month for $1\frac{1}{2}$ years.

Solution :

Given $P = \text{₹ } 2,500$ and $R = 1.5\%$ per month,

and time $(T) = 1\frac{1}{2}$ years $= \frac{3}{2} \times 12$ months $= 18$ months,

$$\therefore \text{Interest} = \frac{P \times R \times T}{100} = \frac{\text{₹ } 2,500 \times 1.5 \times 18}{100} = \text{₹ } 675 \quad (\text{Ans.})$$

When the rate of interest is taken per month, the time must also be in months.

Alternative method :

Given $P = \text{₹ } 2,500$ and $R = 1.5\%$ per month,

$= 1.5 \times 12\%$ per year $= 18\%$ per year,

and time $T = 1\frac{1}{2}$ years $= \frac{3}{2}$ years

$$\therefore \text{Interest } I = \frac{P \times R \times T}{100} = \frac{\text{₹ } 2,500 \times 18 \times 3}{100 \times 2} = \text{₹ } 675 \quad (\text{Ans.})$$

When the rate of interest is taken per year, the time must also be in years.

EXERCISE 11 (A)

- Find the interest (simple interest) on :
 - ₹ 200 for 3 years at 6% per annum (p.a.).
 - ₹ 800 for 9 months at 1.5 percent per month.
 - ₹ 2,000 for 10 months at 12% per year.
 - ₹ 460 for 8 months at 5 paise per rupee per month. 5 paise per rupee = 5%
 - ₹ 2,450 for 3 years at 12 paise per rupee per year.
- Rohit borrowed ₹ 4,000 from his friend and agreed to pay him interest at the rate of 15% per year. Find :
 - the interest to be paid by Rohit in 2 years
 - the amount that Rohit must pay at the end of the 2nd year in order to clear his debt.
- Sheela deposited ₹ 3,600 in a bank for 3 years. If the bank pays interest on this deposit at the rate of 10 percent per annum, find how much money will Sheela get from the bank at the end of 3 years.
- John lends ₹ 15,000 for 3 years at 8% per annum, and Rahul lends ₹ 25,000 for the same time at 5% per annum. Find :
 - the interest earned by John in 3 years.
 - the interest earned by Rahul in 3 years
 - the amount each gets in 3 years.
 - the difference of their interests.
 - the difference of amounts they finally get.
- A man borrows ₹ 750 at 10% per annum, ₹ 1,200 at 8% per annum, and ₹ 2,000 at 6% per annum. Find the total interest paid by him in 4 years.
Also, find (i) the total sum borrowed and (ii) the total amount the man has to pay at the end of 4 years to clear his debt.

11.3 INVERSE PROBLEMS ON SIMPLE INTEREST

The formula $\text{Interest} = \frac{\text{Principal} \times \text{Rate} \times \text{Time}}{100}$

can be re-written as

(i) $\text{Principal} = \frac{100 \times \text{Interest}}{\text{Rate} \times \text{Time}}, \quad \text{i.e. } P = \frac{100 \times I}{R \times T}$

(ii) $\text{Rate}\% = \frac{100 \times \text{Interest}}{\text{Principal} \times \text{Time}}\%, \quad \text{i.e. } R\% = \frac{100 \times I}{P \times T}\%$

and

(iii) $\text{Time} = \frac{100 \times \text{Interest}}{\text{Principal} \times \text{Rate}}, \quad \text{i.e. } T = \frac{100 \times I}{P \times R}$

11.4 WHEN PRINCIPAL IS REQUIRED

Example 3 :

The interest on a certain loan for 5 years at 6% was ₹ 120. What was the loan ?

Solution :

Given Rate = 6%, Time = 5 years and Interest = ₹ 120

$$\therefore \text{Principal (Loan)} = \frac{100 \times \text{Interest}}{\text{Rate} \times \text{Time}} = \frac{100 \times ₹ 120}{6 \times 5} = ₹ 400 \quad (\text{Ans.})$$

Example 4 :

Find the principal that will amount to ₹ 1,300 in $2\frac{1}{2}$ years at 12% per annum.

Solution :

Let the principal be ₹ 100.

$$\therefore \text{Interest } I = \frac{P \times R \times T}{100} = \frac{₹ 100 \times 12 \times 5}{100 \times 2} = ₹ 30$$

$$\Rightarrow \text{Amount} = ₹ 100 + ₹ 30 = ₹ 130$$

$$\text{Amount} = \text{Principal} + \text{Interest}$$

Applying unitary method, we get :

When amount = ₹ 130, principal = ₹ 100

$$\Rightarrow \text{When amount} = ₹ 1, \text{ principal} = ₹ \frac{100}{130}$$

$$\Rightarrow \text{When amount} = ₹ 1,300, \text{ principal} = ₹ \frac{100}{130} \times 1,300 = ₹ 1,000 \quad (\text{Ans.})$$

Alternative (algebraic) method :

Let the principal be ₹ x

$$\therefore \text{Interest } I = \frac{P \times R \times T}{100} = \frac{₹ x \times 12 \times 5}{100 \times 2} = ₹ \frac{3x}{10}$$

Since Principal + Interest = Amount

$$\Rightarrow x + \frac{3x}{10} = 1300, \quad \text{i.e. } \frac{10x + 3x}{10} = 1300$$

$$\Rightarrow \frac{13x}{10} = 1300 \text{ and } x = 1300 \times \frac{10}{13}, \quad \text{i.e. } x = 1000$$

$$\therefore \text{Principal} = ₹ 1,000 \quad (\text{Ans.})$$

11.5 WHEN RATE IS REQUIRED

Example 5 :

If the interest on ₹ 600 for 5 years is ₹ 60, find the rate of interest.

Solution :

Given Principal (P) = ₹ 600, Interest (I) = ₹ 60 and Time (T) = 5 years,

$$\therefore \text{Rate} = \frac{100 \times I}{P \times T} \% = \frac{100 \times 60}{600 \times 5} \% = 2\% \quad (\text{Ans.})$$

11.6 WHEN TIME IS REQUIRED

Example 6 :

In how much time will the interest on ₹ 800 amount to ₹ 100 at 5% p.a. ?

Solution :

Given Principal (P) = ₹ 800, Interest (I) = ₹ 100 and Rate (R) = 5%

$$\therefore \text{Time} = \frac{100 \times I}{P \times R} = \frac{100 \times 100}{800 \times 5} \text{ years} = 2\frac{1}{2} \text{ years} \quad (\text{Ans.})$$

Example 7 :

In how many years will a sum of money triple itself, the rate of interest being 5 percent per annum ?

Solution :

Let sum (Principal) = ₹ 100

$\therefore$ Amount = $3 \times ₹ 100 = ₹ 300$

and Interest = $A - P$
 $= ₹ 300 - ₹ 100 = ₹ 200$

So we have : P = ₹ 100, I = ₹ 200 and R = 5%

$$\therefore \text{Time} = \frac{100 \times I}{P \times R} = \frac{100 \times 200}{100 \times 5} \text{ years} = 40 \text{ years} \quad (\text{Ans.})$$

EXERCISE 11 (B)

- Find the principal that will yield an interest of :
 - ₹ 60 in 5 years at the rate of 4% per annum.
 - ₹ 680 in 4 years at 8% per annum.
- Find the principal that will amount to :
 - ₹ 729.60 at 7% per annum in 4 years.
 - ₹ 2,240 at 4% per annum simple interest in 3 years.
- At what percent rate per annum will the simple interest be :
 - ₹ 85.50 on ₹ 570 in 5 years ?
 - ₹ 720 on ₹ 960 in 15 years ?
- At what percent rate per annum of simple interest will :
 - ₹ 1,000 amount to ₹ 1,400 in 4 years ?
 - a sum of money double in 5 years ?

5. Find the time in which the simple interest on :
 (i) ₹ 5,000 at 5% p.a. will be ₹ 750. (ii) ₹ 154 at 6% p.a. will be ₹ 92.40.
6. In what time will :
 (i) ₹ 3,200 amount to ₹ 4,224 at 8% per annum ?
 (ii) ₹ 2,500 amount to ₹ 4,375 at 5% per annum ?
7. At what percent rate per annum will a sum of money be five times itself in 10 years ?
8. In what time will a sum of money double itself, the rate of interest per annum being 20% ?

REVISION EXERCISE (Chapter 11)

1. Find the principal on which the interest in 5 years at 11% per year is ₹ 8,800.
2. Find the principal that amounts to ₹ 9,750 in 3 years at 10% per annum.
3. At what rate per annum will ₹ 8,000 earn an interest of ₹ 3,240 in $4\frac{1}{2}$ years ?
4. At what rate per annum will ₹ 37,500 amount to ₹ 45,000 in $2\frac{1}{2}$ years ?
5. Find the time in which the simple interest on ₹ 14,000 at 10% per annum is ₹ 5,600.
Also, find the amount at the end of this time.
6. Find the time in which a sum of ₹ 3,500 amounts to ₹ 5,460 at 8% per annum.
7. At what percent rate per annum will a sum of money be four times itself in 12 years ?
8. Rajiv lent ₹ 8,000 at 10% per annum S.I. for 4 years and ₹ 10,000 at 5% per annum for 7 years.
Find the total interest earned by Rajiv.
9. Equal sums of ₹ 18,000 were lent to Manoj and John at 10% per year for a period of 3 years and 5 years, respectively. Find the difference of the two interests received.
10. Prem and Geeta each took a loan of ₹ 12,000 from a bank at the same rate of interest. If Geeta cleared her loan by paying ₹ 16,320 at the end of 3 years; find the :
 (i) interest paid by Geeta,
 (ii) rate of interest paid by Geeta
 (iii) rate of interest paid by Prem
 (iv) interest paid by Prem in 5 years
 (v) total money paid by Prem to clear his loan at the end of 5 years.
11. A sum of ₹ 7,000 will amount to ₹ 8,120 in 2 years at a certain rate of interest. Calculate :
 (i) the interest earned.
 (ii) the rate of interest.
 (iii) the amount for ₹ 8,000 in 5 years at the rate of interest as obtained above.
12. A sum of ₹ 21,000 amounts to ₹ 24,780 in 3 years. Find :
 (i) the interest (simple interest).
 (ii) the rate of interest.
 (iii) the time in which ₹ 15,000 will earn ₹ 3,000 as simple interest at the rate obtained above.
13. Geeta borrowed a certain sum from a money lender at 10% simple interest for 6 years. If, by paying ₹ 32,000 at the end of this period, she cleared her debt, find the sum borrowed by her.

14. The simple interest on a certain sum of money is three-fifths of itself in 3 years. Calculate the rate of interest charged.

$$\text{Let } P = ₹ 100 \Rightarrow I = \frac{3}{5} \times ₹ 100 = ₹ 60$$

$$\therefore R\% = \frac{I \times 100}{P \times T} \% = \frac{60 \times 100}{100 \times 3} \% = \mathbf{20\%}$$

15. The simple interest on a certain sum is three-fourths of itself. If the rate of interest is 10%, find the time.