

## MODULE 6 – SIMPLE INTEREST AND COMPOUND INTEREST

1. Shankar deposited Rs. 9000 in a bank at a simple interest at an annual interest of 8%. How much will the amount yield him in two and a half years?

- (a) Rs. 10800                      (b) Rs. 9000                      (c) Rs. 1800                      (d) Rs. 9350

**Solution:**

Simple Interest =  $PRT/100$

Principal =  $P = \text{Rs.} 9000$

Time Period =  $T = 2.5 \text{ years}$

Amount after 2.5 years = Principal + Simple Interest

Amount =  $9000 + 9000 \times 8 \times 2.5/100 = 9000 + 1800 = \text{Rs.} 10800$

2. Simple interest on a certain sum at a certain rate of interest for 2 years is Rs. 40 and compound interest for 2 years is RS. 40.80. Find the rate of interest and principal?

- (a) 4%, Rs. 500                      (b) 4%, Rs. 400                      (c) 10%, Rs. 200                      (d) 20%, Rs. 80

**Solution:**

	SI	CI
1st year	20	20
2nd year	20	$20 + (.80)$

$$0.8 = 20 \times r / 100$$

$$r = 4\%$$

$$4\% \text{ of } P = 20$$

$$P = (100 \times 20) / 4 = 500$$

**Alternate solution:**

Going with the option.a) Simple interest on 500 at 4% per annum interest rate is 4% of 500 = 20 Rs.. In two years, the interest results in 40 Rs. Hence option a)

3. Veeru invested Rs 20000 at 10% simple annual interest, and exactly after four years, Joy invested Rs 16000 at 20% simple annual interest. How many years after Veeru's investment, will their balances, i.e., principal plus accumulated interest, be equal?

- (a) 10                      (b) 8                      (c) 14                      (d) 25

**Solution:**

Let after  $n$  years both the sums amount to the equal amounts.

$$\text{Then, } 20000 (1 + 10\%(n+4)100) = 16000 (1 + 20\% n)100$$

$$n = 10$$

Hence 14 years after Veerus investment, their balances will be equal.

4. A sum of Rs. 725 is lent at the beginning of a year at a certain rate of interest, simple interest. After 8 months, a sum of Rs. 362.50 more is lent but at the rate twice the former. At the end of the year, Rs. 33.50 is earned as interest from both the loans. What was the original rate of interest?

- (a) 3.6% (b) 4.5% (c) 5% (d) 3.46%

**Solution:**

Let the original rate be  $R\%$ . Then, the new rate =  $(2R)\%$ .

Here, the original rate is for 1 year(s); the new rate is for only 4 months i.e. for  $1/3$  year.

$$\therefore [(725 \times R \times 1)/100] + [362.50 \times 2R \times 1/(100 \times 3)] = 33.50$$

$$\square (2175 + 725) R = 33.50 \times 100 \times 3$$

$$\square (2175 + 725) R = 10050$$

$$\square (2900) R = 10050$$

$$\square R = (10050/2900) = 3.46$$

$$\therefore \text{Original rate} = 3.46\%$$

5. An investment doubles itself in 15 years if the interest is compounded annually. How many years will it take to become 8 times?

- (a) 35 years (b) 40 years (c) 45 years (d) 30 years

**Solution:**

It is given that the investment doubles itself in 15 years.

Let the initial investment be Rs.  $P$

$$\square \text{At the end of 15 years, } A = 2P$$

Now, this  $2P$  will be invested.

$$\square \text{Amount after 15 more years} = 2 \times 2P = 4P$$

Now, this  $4P$  will be invested.

$$\square \text{Amount after 15 more years} = 2 \times 4P = 8P$$

Thus, the investment ( $P$ ) will become 8 times ( $8P$ ) in  $15 + 15 + 15 = 45$  years

6. The difference between the SI and CI on a certain sum of money at 10 % rate of annual interest for 2 years is Rs. 649. Find the sum.

- (a) Rs. 64900 (b) Rs. 63700 (c) Rs. 69400 (d) Rs. 66800

**Solution:**

Let the sum be  $P$ .

$$R = 10\%$$

$$n = 2 \text{ years}$$

$$SI = P \times R \times n / 100 = P \times 10 \times 2 / 100 = 0.20P$$

$$CI = A - P = P [1 + (R / 100)]^n - P = 0.21P$$

Now, it is given that  $CI - SI = 649$

$$\square 0.21P - 0.20P = 649$$

$$\square 0.01P = 649$$

$$P = 64900$$

Therefore, the required sum of money is Rs. 64,900

7. A sum of Rs. 1000 is to be divided among two brothers A and B such that if the interest being compounded annually is 5 % per annum, then the money with A after 4 years is equal to the money with B after 6 years. Find their shares?

$$(a) A - 542.83, B - 457.17$$

$$(b) A - 524.38, B - 475.62$$

$$(c) A - 538.24, B - 461.76$$

$$(d) A - 543.82, B - 456.18$$

**Solution:**

Let A be given Rs. P

$$\text{Money with B} = \text{Rs. } 1000 - P$$

Now, according to the question,

$$P [1 + (5 / 100)]^4 = (1000 - P) [1 + (5 / 100)]^6$$

$$P (1.05)^4 = (1000 - P) (1.05)^6$$

$$0.9070 P = 1000 - P$$

$$1.9070 P = 1000$$

$$P = 524.38$$

Therefore, share of A = Rs. 524.38

Share of B = Rs. 475.62

8. The simple interest on a certain sum of money for 3 years at 8% per annum is half the compound interest on Rs.4000 for 2 years at 10% per annum. The sum placed on simple interest is

$$(a) \text{Rs. } 1550$$

$$(b) \text{Rs. } 1650$$

$$(c) \text{Rs. } 1750$$

$$(d) \text{Rs. } 2000$$

**Solution:**

Principle = Rs 4000

Time = 2 year

Rate = 10%

$$\text{Compound interest} = P \times (1+r)^n - P$$

$$I = P \{ (1+r)^n - 1 \}$$

$$I = 4000(1+0.1)^2 - 1$$

$$I = 4000(1.21 - 1)$$

$$I = 840$$

As per question, Simple interest =  $840/2 = 420 = PRT/100$

$$\text{So, } I = 420 = P \times 0.08 \times 3$$

$$I = 1750 \text{ Rs Answer (c) } 1750 \text{ Rs}$$

9. Hari lends a sum of Rs.8000 at 20% per annum at compound interest. He obtains an amount of Rs.13824 after a certain period. After how many years will he get that amount?

$$(a) 2$$

$$(b) 1$$

$$(c) 4$$

$$(d) 3$$

**Solution:**

Let Principal = P, Rate = R% per annum, Time = n years

When interest is compounded annually, total amount can be calculated by using the formula

$$\text{Compound Amount} = P (1 + R / 100)^n$$

Given that, P = Rs.8000, R = 20% per annum

Compound Amount = Rs. 13824

We have to find the time period during which the amount will be Rs.13824

$$\Rightarrow \text{Rs.13824} = 8000 \times (1 + 20/100)^n$$

$$\Rightarrow (13824 / 8000) = (120 / 100)^n$$

$$\Rightarrow (24 / 20)^3 = (12 / 10)^n$$

$$\Rightarrow (12 / 10)^3 = (12 / 10)^n$$

Therefore,  $n = 3$ .

Hence the required time period is 3 years.

10. Ramesh takes a loan of Rs 20000 from Karan at a simple interest of 20%. He agrees to clear the loan, along with the interest, in four equal instalments, each at the end of one year, for four years. But, Karan puts forward a condition that he will continue to calculate the interest on the original amount lent till Ramesh completely pays off his loan. What is the value of each instalment?

- a) Rs 9000                      b) Rs 9500                      c) Rs 10000                      d) None of these

**Solution:**

The loan is taken for simple interest  $\Rightarrow$  Interest is always calculated on the initial principal amount and not on the outstanding amount.

$\Rightarrow$  The interest for each of the four years is the same, which is equal to

$$= 20000 \times 20 \times 1/100 = \text{Rs} = 4000$$

Interest for four years =  $4 \times 4000 = \text{Rs} 16000$ .

Total amount =  $20000 + 16000 = \text{Rs} 36000$

$\Rightarrow$  Each equal instalment =  $36000 / 4 = \text{Rs} 9000$

11. The compound interest on a sum for 2 years is Rs. 832 and the simple interest on the same sum for the same period is Rs. 800. The difference between the compound and simple interest for 3 years will be:

- (a) Rs. 48                      (b) Rs. 66.56                      (c) Rs. 98.56                      (d) None of these

**Solution:**

Given that simple interest for 2 years is Rs.800

i.e., Simple interest for 1st year is Rs.400

and simple interest for 2nd year is also Rs.400

Compound interest for 1st year will be 400

and Compound interest for 2nd year will be  $832 - 400 = 432$

you can see that compound interest for 2nd year is more than simple interest for 2nd year by  $432 - 400 = \text{Rs.}32$

i.e, Rs. 32 is the interest obtained for Rs.400 for 1 year

Rate,  $R = 100 \times \text{SI} / \text{PT}$

$$= 100 \times 32 / 400 \times 1$$

$$= 8\% \text{Rate}$$

Difference between compound and simple interest for the 3rd year

= Simple Interest obtained for Rs.832

$$= \text{PRT} / 100 = 832 \times 8 \times 1 / 100 = \text{Rs.} 66.56$$

Total difference between the compound and simple interest for 3 years

$$= 32 + 66.56 = \text{Rs.}98.56$$

12. At the end of 3 years, the difference between the compound interest and simple interest comes to be Rs 320. The rate of interest is 25%. Find the principal amount.

- (a) Rs. 1525.50                      (b) Rs. 1545.78                      (c) Rs. 1550                      (d) Rs. 1575.38

**Solution:**

Principal = P

$$\text{Compound Interest} = \text{Total Amount} - \text{Principal} = P \left( 1 + \frac{R}{100} \right)^n - P$$

$$\text{Simple Interest} = \frac{PRT}{100}$$

R = 25% per annum; T and n = 3 years

Compound Interest - Simple Interest = Rs. 320

$$P \left( 1 + \frac{R}{100} \right)^n - P - \frac{PRT}{100} = 320$$

$$\therefore P \left( 1 + \frac{25}{100} \right)^3 - P - \frac{P \times 25 \times 3}{100} = 320$$

$$\therefore P \left( \frac{5}{4} \right)^3 - P - \frac{3P}{4} = 320$$

$$\therefore P \left( \frac{125}{64} \right) - \left( P + \frac{3P}{4} \right) = 320$$

$$\therefore \frac{125P}{64} - \frac{7P}{4} = 320$$

$$\therefore P = \text{Rs. 1575.38}$$

13. John borrowed Rs. 2,10,000 from a bank at an interest rate of 10% per annum, compounded annually. The loan was repaid in two equal instalments, the first after one year and the second after another year. The first instalment was interest of one year plus part of the principal amount, while the second was the rest of the principal amount plus due interest thereon. Then each instalment, in Rs., is

- (a) Rs. 1,21,000                      (b) Rs. 1,20,000                      (c) Rs. 1,22,000                      (d) Cannot be determined

**Solution:**



Given, money borrowed = Rs. 2,10,000

At 10% Interest, after 1 year

Outstanding amount = Rs.  $1.1 \times 2,10,000$  = Rs. 2,31,000

Let the First Installment be x

So, Due amount = Rs. 2,31,000 - x

This due amount is carried over to the second year, with an interest of 10%

So, Outstanding amount for Second year = Rs.  $1.1 \times (2,31,000 - x)$

This amount will be paid as Second Installment

We know, Installment for year 1 = Installment for year 2 = Rs. x

$1.1 \times (2,31,000 - x) = x$

$2.1x = 2,54,100$

$x = \text{Rs. } 1,21,000$

14. A sum of money invested for a certain number of years at 8% p.a. simple interest grows to Rs.180. The same sum of money invested for the same number of years at 4% p.a. simple interest grows to Rs.120. For how many years was the sum invested?

(a) 25 years      (b) 40 years      (c) 33 years and 4 months      (d) Cannot be determined

### Solution:

From the information provided we know that,

Principal + 8% p.a. interest on principal for n years = 180.....(1)

Principal + 4% p.a. interest on principal for n years = 120.....(2)

Subtracting equation (2) from equation (1), we get

4% p.a. interest on principal for n years = Rs.60.

Now, we can substitute this value in equation (2),

i.e Principal + 60 = 120

= Principal = Rs.60.

We know that  $SI = \frac{pnr}{100}$ , where p is the principal, n the number of years and r the rate percent of interest.

In equation (2), p = Rs.60, r = 4% p.a. and the simple interest = Rs.60.

Therefore,  $60 = \frac{(60 \times n \times 4)}{100}$

$\Rightarrow n = \frac{100}{4} = 25$  years.

15. In the beginning of the year 2004, a person invests some amount in a bank. In the beginning of 2007, the accumulated interest was Rs.10,000 and in the beginning of 2010, the accumulated interest became Rs.25,000. The interest rate is compounded annually and the annual interest rate is fixed. The principal amount is\_:

- (a) Rs. 16000      (b) Rs. 18000      (c) Rs. 20000      (d) Rs. 25000

**Solution:**

Interest from the start of 2004 to the start of 2007 (for 3 years) = Rs.10,000

Interest from the start of 2004 to the start of 2010 (for 6 years) = Rs.25,000

Let the principal = x

And annual interest rate = 100r%

The formula to compute the Amount when a sum is invested in compound interest is given as follows:

$$A = P \left[ 1 + \frac{r}{100} \right]^n$$

Where A is the amount, P is the principal, r is the rate of interest per annum in % and n is the number of years

We have assigned x as the principal and 100r% as the rate of interest.

∴ The amount for 3 years  $A_3 =$

$$x \left[ 1 + \frac{100r}{100} \right]^3 =$$

$$x(1 + r)^3 = x + 10000 \text{ (Amount = Principal + Interest)}$$

$$\text{And amount for 6 years } A_6 = x(1 + r)^6 = x + 25000$$

Further let us take,  $(1 + r)^3 = a$

$$\text{Then, } x(1 + r)^3 = xa = x + 10000 \text{ ..... (1)}$$

$$\text{And } x(1 + r)^6 = xa^2 = x + 25000 \text{ .....(2)}$$

Solve the two equations to find x

$$xa = x + 10000 \text{ .....(1)}$$

$$xa^2 = x + 25000 \text{ .....(2)}$$

Bringing x terms to one side in both the equations, we can rewrite the two equations as

$$x(a - 1) = 10000$$

$$x(a^2 - 1) = 25000$$

$$\text{Equation (2) can therefore be expressed as } x(a^2 - 1) = x(a - 1)(a + 1) = 25000$$

$$\text{We know from equation (1) } x(a - 1) = 10000$$

$$\text{Substitute } x(a - 1) = 10000 \text{ in equation (2). } \therefore x(a - 1)(a + 1) = 10000(a + 1) = 25000$$

$$\text{Or, } (a + 1) = 25000 / 10000 = 2.5$$

$$\text{If } a + 1 = 2.5, a - 1 = (a + 1 - 2) = 2.5 - 2 = 0.5$$

From equation (1) we know  $x(a - 1) = 10000$

We have computed  $(a - 1) = 0.5$

So,  $x = 10000 / 0.5 = 20000$

## HOMEWORK:

1. The simple interest charged on an amount of Rs. 22,500 at the end of four years is Rs. 10,800. What will be the compound interest on the same amount at the same rate at the end of two years?

- (a) Rs. 14,908                      (b) Rs. 5,724                      (c) Rs. 26,234                      (d) Rs. 8,568

**Solution:**

$$\text{Rate} = \frac{10800 \times 100}{22500 \times 4} = 12\%$$

$$\text{Therefore, CI} = 22500 [(1 + 12/100)^2 - 1]$$

$$= 22500 (1.252 - 1)$$

$$= \text{Rs. } 5724$$

2. An amount of Rs.15000 was invested in bank A and B at simple interest 15% and 10% pa respectively. If the person earned a total of Rs. 5400 as simple interest in 3 years. The amount invested in bank A and B are respectively

- (a) Rs. 9000 & Rs. 6000                      (b) Rs. 6000 & Rs. 9000  
(c) Rs. 6500 & Rs. 8500                      (d) Rs. 5000 & Rs. 10000

**Solution:**

Let P is amount invested in bank A

$$P \times 15 \times 3 / 100 + (15000 - P) \times 10 \times 3 / 100 = 5400$$

$$\Rightarrow P = 6000$$

3. A sum of Rs. 91,000 is borrowed at 20% per annum compounded annually for two years. If it were borrowed at the rate of 100/7% per annum simple interest for four years then, find the difference between C.I and S.I

- (a) Rs. 16,910                      (b) Rs. 12,800                      (c) Rs. 12,960                      (d) Rs. 11,960

**Solution:**

$$\text{CI} = 91000 [(1 + 20/100)^2 - 1]$$

$$= 91000 (1.44 - 1)$$

$$= 91000 \times 44/100$$

$$= 40,040$$

$$\text{And, S.I} = 91000 \times 100 \times 4/700$$

$$= 52,000$$

$$\text{Therefore, required difference} = 52000 - 40040 = \text{Rs. } 11960$$

4. The population of a town was 3600 three years back. It is 4800 right now. What will be the population three years down the line, if the rate of growth of population has been constant over the years?

- (a) 3200                      (b) 4400                      (c) 6000                      (d) 7600

**Solution:**



The population of the town grew from 3,600 to 4,800 in three years.  
Hence, the growth during this 3 year span =  $4,800 - 3,600 = 1,200$

The rate of growth of population is given to be constant.  
Hence, population growth per year =  $1,200/3 = 400$

Hence, total population after three years  
 $= 4,800 + (400 \times 3)$   
 $= 4,800 + 1,200$   
 $= 6,000$

5. Population of a town increases at a certain rate percent per annum. Present population of the town is 3600 and in 5 years it will become 4800. How much will it be in 10 years?

- (a) 5000                      (b) 6000                      (c) 6400                      (d) 7000

**Solution:**

Let rate of increase in population =  $r\%$  p . a

Then,  $4800 = 3600 (1 + r/100)^5$

$\therefore (1 + r/100)^5 = 4800/3600 = 4/3$

Population in the next 5 years will be  $4800 (1 + r/100)^5$   
 $4800 \times 4/3 = 6400$