Exercise 2(A)

1. ₹16,000 is invested at 5% compound interest compounded per annum.
Use the table, given below, to find the amount in 4 years.

Year	Initial amount (₹)	Interest (₹)	Final amount
1st	16,000	800	16,800
2nd			
3rd			
4th			
5th			

Solution:

Year	Initial amount (₹)	Interest (₹)	Final amount
1st	16,000	800	16,800
2nd	16,800	840	17,640
3rd	17,640	882	18,522
4th	18,522	926.10	19,448.10
5th	19,448.10	972.405	20,420.505

Thus, the amount in 4 years is ₹19,448.10

2.(i) Calculate the amount and the compound interest on:
₹6000 in 3 years at 5% per year.
(ii) Calculate amount and the compound interest on:
₹8000 in 2½ years at 15% per annum.
Solution:

(i) Given: P = ₹6,000; N = 3 years and R = 5%

For the 1st year
P = ₹6000; N = 1 year and R = 5%
Interest = (6000 x 5 x 1)/100
= ₹300
And, amount = ₹(6000 + 300)
= ₹6,300
For the 2nd year
P = ₹6300; N = 1 year and R = 5%
Interest = (6300 x 5 x 1)/100
= ₹315
And, amount = ₹(6300 + 315)
= ₹6,615
For the 3rd year
P = ₹6,615; N = 1 year and R = 5%
Interest = (6615 x 5 x 1)/100
= ₹330.75
And, amount = ₹(6,615 + 330.75)

= ₹6,945.75

Hence, the C.I. accrued = Final amount – Initial principal
                        = ₹6,945.75 - ₹6,000
                        = ₹945.75

(ii) Given: P = 8000; N = 2½ years and R = 15%
For the 1st year
P = ₹8,000; N = 1 year and R = 15%
Interest = (8000 x 15 x 1)/100
         = ₹1,200
And, amount = ₹(8,000 + 1,200)
            = ₹9,200
For the 2nd year
P = ₹9,200; N = 1 year and R = 15%
Interest = (9200 x 15 x 1)/100
         = ₹1,380
And, amount = ₹(9,200 + 1,380)
            = ₹10,580
For the next ½ year
P = ₹10,580; N = ½ year and R = 15%
Interest = (10580 x 15 x ½)/100
         = ₹793.50
And, amount = ₹(10,580 + 793.50)
            = ₹11,373.50

Hence, the C.I. accrued = Final amount – Initial principal
                        = ₹11,373.50 - ₹8,000
                        = ₹3,373.50

3. Calculate the amount and the compound interest on:
(i) ₹4,600 in 2 years when the rates of interest of successive years are 10% and 12%
respectively.
(ii) ₹6,000 in 3 years, when the rates of the interest for successive years are 10%, 14%
and 15% respectively.
Solution:

(i) For 1st year
P = ₹4,600; R = 10% and T = 1 year
I = (4600 x 10 x 1)/100
  = ₹460
And,
A = ₹(4,600 + 460)
  = ₹5,060

For 2nd year

P = ₹5,060; R = 12% and T = 1 year.
I = (5060 x 12 x1)/100
  = 60720/100
  = ₹607.20
And,
A = ₹(5,060 + 607.20)
  = ₹5,667.20

Compound interest = ₹(5,667.20 – 4,600)
                  = ₹1,067.20
Amount after 2 years = ₹5,667.20

(ii) For 1st year
P = ₹16,000; R = 10% and T = 1 year
I = (16000 x 10 x 1)/100
  = ₹1,600
And,
A = ₹(16,000 + 1,600)
  = ₹17,600

For 2nd year
P = ₹17,600; R = 14% and T = 1 year
I = (17600 x 14 x 1)/100
  = 246400/100
  = ₹2,464
And,
A = ₹(17,600 + 2,464)
  = ₹20,064

For 3rd year,
P = ₹20,064; R = 15% and T = 1 year
I = (20064 x 15 x 1)/100
  = ₹3,009.60
And,
Amount after 3 years = ₹(20,064 + 3,009.60)
                     = ₹23,073.60
Hence,
Compound interest = ₹(23,073.60 – 16,000)
                  = ₹7,073.60

4. Find the compound interest, correct to the nearest rupee, on ₹2,400 for 2½ years at 5 per cent per annum.
Solution:

For 1st year
P = ₹2400; R = 5% and T = 1 year

I = (2400 x 5 x 1)/100
  = ₹120
A = ₹(2400 + 120)
  = ₹2520

For 2nd year
P = ₹2520; R = 5% and T = 1 year
I = (2520 x 5 x 1)/100
  = ₹126
A = ₹(2,520 + 126)
  = ₹2,646

For the final ½ year
P = Rs. 2646; R = 5% and T = ½ year
I = (2646 x 5 x 1)/(100 x 2)
  = ₹66.15
Amount after 2½ years = ₹2,646 + ₹66.15
                      = ₹2,712.15
Hence,
Compound interest = ₹(2,712.15 – 2,400)
                  = ₹312.15

5. Calculate the compound interest for the second year on ₹8,000 invested for 3 years at 10% per annum.
Solution:

For 1st year
P = ₹8,000; R = 10% and T = 1 year
I = (8000 x 10 x 1)/100
  = 800
And,
A = ₹(8,000 + 800) = ₹8,800

For 2nd year
P = ₹8,800; R = 10% and T = 1 year
I = (8800 x 10 x 1)/100
  = ₹880
Hence,
Compound interest for 2nd years = ₹880

6. A borrowed ₹2,500 from B at 12% per annum compound interest. After 2 years, A gave ₹2,936 and a watch to B to clear the account. Find the cost of the watch.
Solution:

For 1st year
P = ₹2500; R = 12% and T = 1 year

I = (2500 x 12 x 1)/100
  = ₹300
And,
Amount = ₹(2,500 + 300) = ₹2,800

For 2nd year
P = ₹2,800; R = 12% and T = 1 year
I = (2800 x 12 x 1)/100
  = ₹336
And,
Amount = ₹(2,800 + 336) = ₹3136
Now,
Amount repaid by A to B = ₹2936
The amount of watch = ₹(3136 – 2936) = ₹200

7. How much will ₹50,000 amount to in 3 years, compounded yearly, if the rates for the successive years are 6%, 8% and 10% respectively?
Solution:

Given: P = ₹50,000; T = 3 years
Interest for the 1st year, R = 6%
I = (P x R x T)/100
  = (50000 x 6 x 1)/100
  = ₹3,000
And,
Amount after the 1st year = ₹(3,000 + 50,000)
                                    = ₹53,000
Now,
Interest for the 2nd year, R = 8% and P = ₹53,000
I = (P x R x T)/100
  = (53000 x 8 x 1)/100
  = ₹4,240
And,
Amount after the 2nd year = ₹(4,240 + 53,000)
                                     = ₹57,240
Next,
Interest for the 3rd year, R = 10% and P = ₹57,240
I = (P x R x T)/100
  = (57240 x 10 x 1)/100
  = ₹5,724
And,
Amount after the 3rd year = ₹(5,724 + 57,240)
                                     = ₹62,964
Hence, the amount after 3 years will be ₹62,964

8. Meenal lends ₹75,000 at C.I. for 3 years. If the rate of interest for the first two years is

15% per year and for the third year it is 16%, calculate the sum Meenal will get at the
end of the third year.
Solution:

Given: P = ₹75,000; T = 3 years
Interest for the 1st year, R = 15%
I = (P x R x T)/100
  = (75000 x 15 x 1)/100
  = ₹11,250
And,
Amount after the 1st year = ₹(75,000 + 11,250)
                          = ₹86,250

Now,
Interest for the 2nd year, R = 15% and P = ₹86,250
I = (P x R x T)/100
  = (86250 x 15 x 1)/100
  = ₹12,937.50
And,
Amount after the 2nd year = ₹(12,937.50 + 86,250)
                          = ₹99,187.50

Next,
Interest for the 3rd year, R = 16% and P = ₹99,187.50
I = (P x R x T)/100
  = (99187.50 x 16 x 1)/100
  = ₹15,870
And,
Amount after the 3rd year = ₹(15,870 + 99,187.50)
                          = ₹1,15,057.5
Hence, at the end of 3 years Meenal will get an amount of ₹1,15,057.5

**9. Govind borrows ₹18,000 at 10% simple interest. He immediately invests the money
borrowed at 10% compound interest compounded half-yearly. How much money does
Govind gain in one year?**
Solution:

Calculating the simple interest
P = ₹18,000; R = 10% and T = 1year, we have
S.I.= (18000 x 10 x 1)/100
    = ₹1,800

Calculating the compound interest (compounded half-yearly)
For 1st half- year
P = ₹18,000; R = 10% and T = ½ year
Interest = (18000 x 10 x 1)/(100 x 2)
        = ₹900
So,

Amount = ₹18,000 + ₹900 = ₹18,900
Now,
For 2nd half-year
P = ₹18,900; R = 10% and T = ½ year
Interest = (18,900 x 10 x 1)/(100 x 2)
        = ₹945 Rs
So,
Amount = ₹18,900 + ₹945 = ₹19,845
Then,
Compound interest = ₹(19,845 -18,000) = ₹1,845

Therefore,
Govind's gain = ₹(1,845 - 1,800) = ₹45

**10. Find the compound interest on ₹4,000 accrued in three years, when the rate of
interest is 8% for the first year and 10% per year for the second and the third years.
Solution:**

Given: P = ₹4,000; T = 3 years
Interest for the 1st year, R = 8%
I = (P x R x T)/100
  = (4000 x 8 x 1)/100
  = ₹320
And,
Amount after the 1st year = ₹(4,000 +320)
                          = ₹4,320
Now,
Interest for the 2nd year, R = 10% and P = ₹4,320
I = (P x R x T)/100
  = (4320 x 10 x 1)/100
  = ₹432
And,
Amount after the 2nd year = ₹(432 + 4,320)
                          = ₹4,752
Next,
Interest for the 3rd year, R = 10% and P = ₹4,752
I = (P x R x T)/100
  = (4,752 x 10 x 1)/100
  = ₹475.20
And,
Amount after the 3rd year = ₹(475.20 + 4,752)
                          = ₹5,227.20
Hence,
The compound interest = ₹(5227.20 – 4,000)
                      = ₹1,227.20

Exercise 2(B)

1. Calculate the difference between the simple interest and the compound interest on ₹4,000 in 2 years at 8% per annum compounded yearly.
Solution:

For 1ˢᵗ year
P = ₹4,000; R = 8% and T = 1 year
I = (4,000 x 8 x 1)/100
  = ₹320
And,
A = ₹(4,000 + 320)
  = ₹4,320

For 2ⁿᵈ year
P = ₹4,320; R = 8% and T = 1 year
I = (4,320 x 8 x 1)/100
  = ₹345.60
And,
A = ₹(4,320 + 345.60)
  = ₹4,665.60
Hence,
Compound interest = ₹(4,665.60 – 4,000)
                  = ₹665.60

Now,
Simple interest for 2 years = (4000 x 8 x 2)/100
                            = ₹640
Hence,
Difference of CI and SI = ₹(665.60 – 640)
                        = ₹25.60

2. A man lends ₹12,500 at 12% for the first year, at 15% for the second year and at 18% for the third year. If the rates of interest are compounded yearly ; find the difference between the C.I. for the first year and the compound interest for the third year.
Solution:

For 1ˢᵗ year
P = Rs. 12500; R = 12% and R = 1 year
I = (12500 x 12 x 1)/100
  = ₹1,500
And,
A = ₹(12,500 + 1,500)
  = ₹14,000

For 2ⁿᵈ year
P = ₹14,000; R = 15% and T = 1 year

I = (14000 x 15 x 1)/100
   = ₹2,100
And,
A = ₹(1,400 + 2,100)
   = ₹16,100

For 3rd year
P = ₹16,100; R = 18% and T = 1 year
I = (16100 x 18 x 1)/100
   = ₹2898
And,
A = ₹(16,100 + 2,898)
   = ₹18,998

Hence,
The difference between the compound interest of the third year and first year
= ₹2,898 - ₹1,500
= ₹1,398

3. A sum of money is lent at 8% per annum compound interest. If the interest for the second year exceeds that for the first year by ₹96, find the sum of money.
Solution:

Let's assume the money lent to be ₹100
So,
For 1st year
P = ₹100; R = 8% and T = 1 year
Interest for the first year = (100 x 8 x 1)/100
                           = ₹8
Amount = ₹(100+ 8)
       = ₹108

For 2nd year
P = ₹108; R = 8% and T = 1year
Interest for the second year = (108 x 8 x 1)/100
                             = ₹8.64
Now,
Difference between the interests for the second and first year = ₹(8.64 - 8) = ₹0.64

But given that interest for the second year exceeds the first year by ₹96
Then,
When the difference between the interests is ₹0.64, principal is ₹100
So,
When the difference between the interests is ₹96, principal = ₹(96 x 100/0.64)
                                                            = ₹15,000
Therefore, the sum of money lent is ₹15,000

**4. A man borrows ₹6,000 at 5% C.I. per annum. If he repays ₹1,200 at the end of each
year, find the amount of the loan outstanding at the beginning of the third year.
Solution:**

Given, amount borrowed = ₹6,000 at R = 5% C.I. per annum
So,
Interest for the 1st year = (5/100 x 6000)
                        = ₹300
And, the amount at the end of the first year will be
= ₹(6,000 + 300)
= ₹6,300
Given that an amount of ₹1,200 is repaid at the end of each year
Now,
The amount left to the paid at the end of 1st year
= ₹(6,300 – 1,200)
= ₹5,100

Then, the interest for the 2nd year is
= (5/100 x 5100)
= ₹255
And, the amount will be = ₹(5100 + 255)
                      = ₹5,355
Now, the amount left to be paid at the end of 2nd year after reduction of ₹1,200 will be
= ₹(5,355 – 1,200)
= ₹4,155

Hence, the amount of the loan outstanding at the beginning of the third year is ₹4,155

**5. A man borrows ₹5,000 at 12 percent compound interest payable every six months. He
repays ₹1,800 at the end of every six months. Calculate the third payment he has to
make at the end of 18 months in order to clear the entire loan.
Solution:**

For 1st six months:
P = ₹5,000; R = 12% and T = ½ year
Interest = (5000 x 12 x 1)/(2 x 100)
        = ₹300
And, Amount = ₹(5,000 + 300)
            = ₹5,300
Given that the money repaid = ₹1,800
So, balance amount = ₹(5,300 - 1,800)
                   = ₹3,500

For 2nd six months:
P = ₹3,500; R = 12% and T = ½ year

Interest = (3500 x 12 x 1)/(2 x 100)
        = ₹210
And, Amount = ₹(3,500 + 210)
          = ₹3,710
Again the money repaid = ₹1,800
So, balance amount = ₹(3,710 - 1,800)
                = ₹1,910

For 3rd six months:
P = ₹1,910; R = 12% and T = ½ year
Interest = (1910 x 12 x 1)/(2 x 100)
        = ₹114.60
And, Amount = ₹(1,910 + 114.60)
          = ₹2,024.60

Hence, the 3rd payment to be made to clear the entire loan is ₹2,024.60

6. On a certain sum of money, the difference between the compound interest for a year, payable half-yearly, and the simple interest for a year is ₹180. Find the sum lent out, if the rate of interest in both the cases is 10% per annum.
Solution:

Let assume a principal of ₹100
And, for R = 10% and T = 1 year
S.I. = (100 x 10 x 1)/100
     = ₹10

Compound interest payable half yearly
R = 5% half-yearly, T = ½ year = 1 half-year
Now, for first ½ year
I = (100 x 5 x 1)/100
  = ₹5
And,
A = ₹(100 + 5)
  = ₹105

For second ½ year
P = ₹105 and R = 5%
I = (105 x 5 x 1)/100
  = ₹5.25

Total compound interest = ₹(5 + 5.25)
                      = ₹10.25
Difference of C.I. and S.I. = ₹(10.25 – 10)
                      = ₹0.25
So, when difference in interest is ₹10.25, the sum is ₹100

So, if the difference is ₹1, the sum is (100/0.25) = 400
And,
If the difference is ₹180, the sum will be ₹(400 x 180) = ₹72,000
Hence, the sum lent out is ₹72,000

**7. A manufacturer estimates that his machine depreciates by 15% of its value at the
beginning of the year. Find the original value (cost) of the machine, if it depreciates by
₹5,355 during the second year.**
Solution:

Let's assume the original cost of the machine to be ₹100
Given that the machine depreciates by 15% during the first year
So, 15% of ₹100 = ₹15
Now,
The value of the machine at the beginning of the 2ⁿᵈ year will be
= ₹(100 – 15)
= ₹85
Again, the depreciation during the 2ⁿᵈ year = 15% of ₹85 = ₹12.75
Now,
When the depreciation during the 2ⁿᵈ year is ₹12.75, the original cost is ₹100
So,
When the depreciation during the 2ⁿᵈ year is ₹5,355, the original cost will be
= (100 x 5355)/12.75
= ₹42,000

Therefore, the original cost of the machine is ₹42,000

8. A man invest ₹5,600 at 14% per annum compound interest for 2 years. Calculate:
(i) The interest for the first year.
(ii) The amount at the end of the first year.
(iii) The interest for the second year, correct to the nearest rupee.
Solution:

(i) For the 1ˢᵗ year
P = ₹5,600; R = 14% and T = 1 year
I = (5600 x 14 x 1)/100
  = ₹784
And,
(ii) Amount at the end of the first year is
= ₹(5600 + 784)
= ₹6,384

(iii) Now, for the 2ⁿᵈ year
P = ₹6,384; R = 14% and R = 1 year
I = (6384 x 14 x 1)/100

= ₹893.76 ~ ₹894 (nearly)
Hence, the interest for the second year is ₹894

9. A man saves ₹3,000 every year and invests it at the end of the year at 10% compound interest. Calculate the total amount of his savings at the end of the third year.
Solution:

Savings at the end of every year = ₹3,000
So, for 2nd year
P = ₹3,000; R = 10% and T = 1 year
I = (3000 x 10 x 1)/100
  = ₹300
And,
A = ₹(3000 + 300)
  = ₹3,300
Now,
For 3rd year, savings = ₹3,000
So, P = ₹(3,000 + 3,300) = ₹6,300
R = 10% and T = 1 year
I = (6300 x 10 x 1)/100
  = ₹630
And,
A = ₹(6,300 + 630) = ₹6,930
Amount at the end of 3rd year
= ₹(6,930 + 3,000)
= ₹9,930

Hence, the total amount of his savings at the end of the third year is ₹9,930

10. A man borrows ₹10,000 at 5% per annum compound interest. He repays 35% of the sum borrowed at the end of the first year and 42% of the sum borrowed at the end of the second year. How much must he pay at the end of the third year in order to clear the debt?
Solution:

Given,
The amount borrowed is ₹10,000 at R = 5%
Interest for the 1st year
I = (10000 x 5)/100
  = ₹500
And, the amount at the end of 1st year = ₹(10,000 + 500)
                                          = ₹10,500

It's said that the man pays 35% of ₹10,500 at the end of the first year
= (35 x 10500)/100
= ₹3,675

So, the amount left to be paid will be
= ₹(10,500 – 3,675)
= ₹6,825

Now,
The interest for the 2nd year is
I = (6,825 x 5)/100
  = ₹341.5
So, the amount at the end of the 2nd year will be
= ₹(6,825 + 341.25)
= ₹7,166.25

Given that the man pays 42% of ₹7,166.25 at the end of 2nd year
= (42 x 7166.25)/100
= ₹3,009.825
So, the amount left to be paid = ₹(7,166.25 – 3,009.825)
                                    = ₹4,156.425

Now, the interest for the third year
= (4156.425 x 5)/100
= ₹207.82125
So, the amount at the end of the third year will be
= (4,156.425 + 207.82125)
= ₹4,364.24625

Hence, the man must pay an amount of ₹4,364.24625 at the end of 3rd year in order to clear the debt.

Exercise 2(C)

1. A sum is invested at compound interest, compounded yearly. If the interest for two successive years is ₹5,700 and ₹7,410, calculate the rate of interest.
Solution:

We know that.
Rate of interest (%) = (Difference in the interest of the two consecutive periods x 100)/(C.I. of preceding year x time)

$$= [(7410 - 5700) \times 100]/(5700 \times 1)$$
$$= 30\%$$

Hence, the rate of interest is 30%

2. A certain sum of money is put at compound interest, compounded half-yearly. If the interest for two successive half-years are ₹650 and ₹760.50; find the rate of interest.
Solution:

The difference between the C.I. of two successive half-years is
= ₹(760.50 – 650)
= ₹110.50
So, ₹110.50 is the interest of one half-year on ₹650
Thus,
Rate of interest = (100 x I)/(P x T) %

$$= (100 \times 110.50)/(650 \times \frac{1}{2})$$
$$= 34\%$$

3. A certain sum amounts to ₹5,292 in two years and ₹5,556.60 in three years, interest being compounded annually. Find:
(i) the rate of interest.
(ii) the original sum.
Solution:

(i) Given,
Amount in two years = ₹5,292
Amount in three years = ₹5,556.60
So, the difference between the amounts of two successive years is
= ₹5,556.60 - ₹5,292
= ₹264.60
Hence, ₹264.60 is the interest for one year on ₹5,292
Thus,
Rate of interest = (100 x I)/(P x T)

$$= (100 \times 264.60)/(5292 \times 1)$$
$$= 5\%$$

(ii) Let's assume the sum of money to be ₹100
Then, the interest on it for the 1st year will be
= 5% of ₹100

= ₹5
So, the amount in one year = ₹(100 + 5) = ₹105
Similarly,
The amount in two years = ₹105 + 5% of ₹105
= ₹(105+ 5.25)
= ₹110.25
When amount in two years is ₹110.25, sum = ₹100
Hence,
When amount in two years is ₹5,292, sum = ₹(100 x 5292)/110.25
= ₹4,800

4. The compound interest, calculated yearly, on a certain sum of money for the second year is ₹1,089 and for the third year it is ₹1,197.90. Calculate the rate of interest and the sum of money.
Solution:

(i) C.I. for second year = ₹1,089
C.I. for third year = ₹1,197.90
Thus, the difference between the C.I. of two successive years
= ₹(1,197.90 – 1,089)
= ₹108.90
Hence, ₹108.90 is the interest of one year on ₹1,089
Thus,
Rate of interest = (100 x I)/(P x T)
= (100 x 108.90)/(1089 x 1)
= 10%

(ii) Let's assume the sum of money to be ₹100
So, interest on it for in the 1st year = 10% of ₹100
= ₹10
And, the amount after one year = ₹(100 + 10)
= ₹110
Similarly, C.I. for the 2nd year = 10% of ₹110
= ₹11
When C.I. for 2nd year is ₹11, the sum is ₹100
Hence,
When C.I. for 2nd year is ₹1,089, the sum is ₹(100 x 1089)/11 = ₹9,900

5. Mohit invests ₹8,000 for 3 years at a certain rate of interest, compounded annually. At the end of one year it amounts to ₹9,440. Calculate:
(i) the rate of interest per annum.
(ii) the amount at the end of the second year.
(iii) the interest accrued in the third year.
Solution:

For the 1st year

P = ₹8,000; A = ₹9,440 and T = 1 year
Interest = ₹(9,440 - 8,000)
        = ₹1,440
So,
Rate = (I x 100)/(P x T)
    = (1,440 x 100)/(8,000 x 1
    = 18%
(i) Hence, the rate of interest per annum is 18%

For the 2nd year
P = ₹9,440; R = 18% and T = 1year
Interest = (9440 x 18 x 1)/100
        = ₹1,699.20
And,
Amount = ₹ (9,440 + 1,699.20) = ₹11,139.20
(ii) Hence, the amount at the end of second year is ₹11,139.20

For the 3rd year
P = ₹11,139.20; R = 18% and T = 1year
Interest = (11139.20 x 18 x 1)/100
        = ₹2,005.06
(iii) Hence, the interest accrued in the third year is ₹2,005.06

6. Geeta borrowed ₹15,000 for 18 months at a certain rate of interest compounded semi-annually. If at the end of six months it amounted to ₹15,600; Calculate :
(i) the rate of interest per annum.
(ii) the total amount of money that Geeta must pay at the end of 18 months in order to clear the account.
Solution:

For 1st half-year
P = ₹15,000; A = ₹15,600 and T = ½ year
Now,
Interest = ₹(15,600 - 15,000)
        = ₹600
(i) Hence,
Rate = (I x 100)/(P x T)%
    = 8%

For 2nd half-year
P = ₹15,600; R = 8% and T = ½ year
Interest = (15,000 x 8 x ½)/100
        = ₹624
So,
Amount = ₹(15,600 + 624)
        = ₹16,224

<u>For 3rd half-year</u>
P = ₹16,224; R = 8% and T = ½ year
Interest = (16,224 x 8 x ½)/100
        = ₹648.96
So,
Amount = ₹(16,224 + 648.96)
        = ₹16,872.96

Therefore, the total amount of money that Geeta must pay at the end of 18 months in order to clear the account is ₹16,872.96

7. Ramesh invests ₹12,800 for three years at the rate of 10% per annum compound interest. Find:
(i) the sum due to Ramesh at the end of the first year.
(ii) the interest he earns for the second year.
(iii) the total amount due to him at the end of the third year.
Solution:

<u>For 1st year</u>
P = ₹12,800; R = 10% and T = 1year
Interest = (12,800 x 10 x 1)/100
        = ₹1,280
And,
Amount = ₹(12,800 +1,280)
        = ₹14,080
(i) Hence, at the sum due to Ramesh at the end of the first year is ₹14,080

<u>For 2nd year</u>
P = ₹14,080; R = 10% and T = 1 year
Interest = (14,080 x 10 x 1)/100
        = ₹1,408
(ii) Hence, the interest the interest earned for the second year is ₹1,408
And,
Amount = ₹(14,080 + 1,408)
        = ₹15,488

<u>For 3rd year</u>
P = ₹15,488; R = 10% and T = 1 year
Interest = ₹(15,488 x 10 x 1)/100
        = ₹1,548.80
And,
Amount = ₹(15,488 + 1,548.80)
        = ₹17,036.80
(iii) Hence, the total amount due to Ramesh at the end of third year is ₹17,036.80

**8. ₹8,000 is lent out at 7% compound interest for 2 years. At the end of the first year
₹3,560 are returned. Calculate:**
(i) the interest paid for the second year.
(ii) the total interest paid in two years.
(iii) the total amount of money paid in two years to clear the debt.
Solution:

(i) For 1st year
P = ₹8,000; R = 7% and T = 1 year
Interest = (8,000 x 7 x 1)/100
        = ₹560
Amount = ₹(8,000 + 560)
        = ₹8,560
Now, the money returned = ₹3,560
So,
Balance money for 2nd year = ₹(8,560 - 3,560)
                          = ₹5,000
For 2nd year
P = ₹5,000; R = 7% and T = 1 year
Interest paid for the second year = (5000 x 7 x 1)/100
                                  = ₹350

(ii) The total interest paid in two years = ₹(350 + 560)
                                          = ₹910

(iii) The total amount of money paid in two years to clear the debt
= ₹(8,000 + 910)
= ₹8,910

**9. The cost of a machine depreciated by ₹4,000 during the first year and by ₹3,600
during the second year. Calculate:**
(i) The rate of depreciation
(ii) The original cost of the machine
(iii) It's cost at the end of the third year
Solution:

(i) Difference between depreciation in value between the first and second years is
₹(4,000 - 3,600) = ₹400
So, the depreciation of one year on ₹4,000 = ₹400
Hence, the rate of depreciation = (40/4000) x 100%
                                = 10%

(ii) Let's assume ₹100 to be the original cost of the machine
Depreciation during the 1st year = 10% of ₹100
                                 = ₹10
So,

When the values depreciates by Rs.10 during the 1st year, then the original cost is ₹100

Then, when the depreciation during 1st year is ₹4,000, the original cost is
(100/10) x 4,000 = ₹40,000
Hence, the original cost of the machine is ₹40,000.

(iii) Total depreciation during all the three years
= Depreciation in value during (1st year + 2nd year + 3rd year)
= ₹4,000 + ₹3,600 + 10% of (₹40,000 - ₹7,600)
= ₹4,000 + ₹3,600 + ₹3,240
= ₹10,840
Thus,
The cost of the machine at the end of the third year = ₹40,000 - ₹10,840
                                                   = ₹29,160

10. Find the sum, invested at 10% compounded annually, on which the interest for the third year exceeds the interest of the first year by ₹252.
Solution:

Let's assume the sum of money be ₹100
And, the rate of interest = 10% p.a.
Interest at the end of 1st year = 10% of ₹100
                              = ₹10
Amount at the end of 1st year = ₹(100 + 10)
                             = ₹110
Interest at the end of 2nd year = 10% of ₹110
                              = ₹11
Amount at the end of 2nd year = ₹(110 + 11)
                             = ₹121
Interest at the end of 3rd year = 10% of ₹121
                              = ₹12.10
Hence, the difference between interest of 3rd year and 1st year
= ₹(12.10 – 10)
= ₹2.10
Now,
When difference is ₹2.10, the principal is ₹100
When difference is ₹252, the principal = (100 x 252)/(2 x 10)
                                       = ₹12,000
Hence, the sum invested is ₹12,000

11. A man borrows ₹10,000 at 10% compound interest compounded yearly. At the end of each year, he pays back 30% of the sum borrowed. How much money is left unpaid just after the second year?
Solution:

For 1st year

P = ₹10,000; R = 10% and T = 1 year
Interest = (10,000 x 10 x 1)/100
       = ₹1,000
Amount at the end of 1ˢᵗ year = ₹(10,000 + 1,000)
                            = ₹11,000
Money paid at the end of 1ˢᵗ year = 30% of ₹10,000
                                 = ₹3,000
Hence,
Principal for 2ⁿᵈ year = ₹(11,000 - 3,000)
                   = ₹8,000

For 2ⁿᵈ year
P = ₹8,000; R = 10% and T = 1 year
Interest = (8,000 x 10 x 1)/100
       = ₹800
And,
Amount at the end of 2ⁿᵈ year = ₹8,000 + ₹800
                         = ₹8,800
So,
Money paid at the end of 2ⁿᵈ year = 30% of ₹10,000
                               = ₹3,000
Hence,
The principal for 3ʳᵈ year = ₹8,800 - ₹3,000
                      = ₹5,800

12. A man borrows ₹10,000 at 10% compound interest compounded yearly. At the end of each year, he pays back 20% of the amount for that year. How much money is left unpaid just after the second year?
Solution:

For 1ˢᵗ year
P = ₹10,000; R = 10% and T = 1year
Interest = ₹(10,000 x 10 x 1)/100
       = ₹1,000
So,
Amount at the end of 1ˢᵗ year = ₹(10,000 + 1,000)
                           = ₹11,000
And,
Money paid at the end of 1ˢᵗ year = 20% of ₹11,000
                               = ₹2,200
Hence,
Principal for 2ⁿᵈ year = ₹11,000 - ₹2,200 = ₹8,800

For 2ⁿᵈ year
P = ₹8,800; R = 10% and T = 1 year
Interest = ₹(8,000 x 10 x 1)/100
       = ₹880

So,
Amount at the end of 2nd year = ₹8,800 + ₹880
                                                              = ₹9,680
And,
Money paid at the end of 2nd year = 20% of ₹9,680
                                                                    = ₹1,936
Hence,
Principal for 3rd year = ₹9,680 - ₹1,936
                                          = ₹7,744

Exercise 2(D)

1. What sum will amount of ₹6,593.40 in 2 years at C.I., if the rates are 10 per cent and 11 per cent for the two successive years?
Solution:

Let's assume the principal (P) to be ₹100
For 1st year, we have
P = ₹100; R = 10% and T = 1 year
So,
I = (100 x 10 x 1)/100\
  = ₹10
And,
A = ₹(100 + 10) = ₹110
For 2nd year, we have
P = ₹110;R = 11% and T = 1 year
So,
I = (110 x 11 x 1)/100
  = ₹12.10
And,
A = ₹(110 + 12.10)
  = ₹122.10

Now,
If the amount is ₹122.10 for a sum of ₹100
Then,
If amount is ₹1, sum will be ₹(100/122.10)
And,
If amount is ₹6,593.40, sum will be ₹(100/122.10) x 6,593.40 = ₹5,400

Therefore, the sum is ₹5,400

2. The value of a machine depreciated by 10% per year during the first two years and 15% per year during the third year. Express the total depreciation of the machine, as per cent, during the three years.
Solution:

Let's assume the value of machine in the beginning to be ₹100
For 1st year,
Depreciation = 10% of ₹100
            = ₹100
So, the value of machine for second year will become ₹(100 – 10) = ₹90

For 2nd year,
Depreciation = 10% of ₹90 = ₹9
So, the value of machine for third year will become ₹(90 – 9) = ₹81

For 3rd year,
Depreciation = 15% of ₹81 = ₹12.15
So, the value of machine at the end of third year = ₹(81 - 12.15) = ₹68.85
Thus,
Net depreciation = ₹(100 - 68.85) = ₹31.15
Or 31.15%

3. Rachna borrows ₹12,000 at 10 percent per annum interest compounded half-yearly. She repays ₹4,000 at the end of every six months. Calculate the third payment she has to make at end of 18 months in order to clear the entire loan.
Solution:

For 1st half-year
P = ₹12,000; R = 10% and T = ½ year
Interest = ₹(12,000 x 10 x 1)/(100 x 2)
          = ₹600
And,
Amount = ₹12,000 + ₹600
          = ₹12,600
Money paid at the end of 1st half year = ₹4,000
So, the balance money for 2nd half-year = ₹12,600 - ₹4,000
                                        = ₹8,600

For 2nd half-year
P = ₹8,600; R = 10% and T = ½ year
Interest = ₹(8,600 x 10 x 1)/(100 x 2)
          = ₹430
And,
Amount = ₹8,600 + ₹430
          = ₹9,030
Money paid at the end of 2nd half-year = ₹4,000
So, the balance money for 3rd half-year = ₹9,030 - ₹4,000
                                        = ₹5,030

For 3rd half-year
P = ₹5,030; R = 10% and T = ½ year
Interest = ₹(5,030 x 10 x 1)/(100 x 2)
          = ₹251.50
And,
Amount = ₹(5,030 + 251.50)
          = ₹5,281.50

Hence, Rachna has to pay an amount of ₹5,281.50 as third payment in order to clear the entire loan

4. On a certain sum of money, invested at the rate of 10 percent per annum

compounded annually, the interest for the first year plus the interest for the third year is
₹2,652. Find the sum.
Solution:

Let's assume the principal as ₹100
For 1st year
P = ₹100; R = 10% and T = 1year
Interest = ₹(100 x 10 x 1)/100
      = ₹10
And,
Amount = ₹(100 + 10)
      = ₹110
For 2nd year
P = ₹110; R = 10% and T = 1year
Interest = ₹(110 x 10 x 1)/100
      = ₹11
And,
Amount = ₹(110 + 11)
      = ₹121
For 3rd year
P = ₹121; R = 10% and T = 1year
Interest = ₹(121 x 10 x 1)/100
      = ₹12.10
Sum of C.I. for 1st year and 3rd year = ₹(10 + 12.10)
                        = ₹22.10

Now,
When sum is ₹22.10, principal is ₹100
So,
When sum is ₹2,652, principal will be (100 x 2652)/22.10 = ₹12,000

Hence, the sum is ₹12,000

**5. During every financial year, the value of a machine depreciates by 12%. Find the
original cost of a machine which depreciates by ₹2,640 during the second financial year
of its purchase.**
Solution:

Let's assume the original value of the machine to be ₹100
For 1st year
P = ₹100; R = 12% and T = 1 year
Depreciation in 1st year = ₹(100 x 12 x 1)/100
                    = ₹12
Value at the end of 1st year = ₹(100 – 12)
                       = ₹88
For 2nd year
P = ₹88; R = 12% and T = 1year

Depreciation in 2nd year = ₹(88 x 12 x 1)/100
= ₹10.56
Now,
When depreciation in 2nd year is ₹10.56, original cost is ₹100
So,
When depreciation in 2nd year is ₹2,640, original cost will be (100 x 2,640)/10.56
= ₹25,000

Hence, the original cost of the machine is ₹25,000

**6. Find the sum on which the difference between the simple interest and compound
interest at the rate of 8% per annum compounded annually would be ₹64 in 2years.
Solution:**

Let's assume ₹x to be the sum.
So, the S.I. is
= (x × 8 × 2)/100
= 0.16x

Now,
Compound interest
For 1st year:
P = ₹x, R = 8% and T = 1
Interest = (x × 8 × 1)/100
= 0.08x
And, amount = ₹(x + 0.08x)
= ₹1.08x

For 2nd year:
P = ₹1.08x, R = 8% and T = 1
Interest = (1.08x × 8 × 1)/100
= 0.0864x
And, amount = ₹(1.08x + 0.0864x)
= ₹1.1664x
So,
C.I. = Amount - P
= ₹(1.1664x – x)
= ₹0.1664x

Given that,
The difference between the simple interest and compound interest at the rate of 8% per annum
compounded annually should be ₹64 in 2 years.
₹0.1664*x* - ₹0.16*x* = ₹64
₹0.0064*x* = ₹64
x = ₹10000

Therefore, the sum is ₹10,000.

7. A sum of ₹13,500 is invested at 16% per annum compound interest for 5 years. Calculate:
(i) the interest for the first year.
(ii) the amount at the end of first year.
(iii) the interest for the second year, correct to the nearest rupee.
Solution:

For 1st year
P = ₹13,500; R = 16% and T = 1year
Interest = ₹(13,500 x 16 x 1)/100
           = ₹2,160
(i) The interest for the first year is ₹2,160
And,
Amount = ₹13,500 + ₹2,160
           = ₹15,660
(ii) The amount at the end of first year is ₹15,660
For 2nd year
P = ₹15,660; R =16% and T = 1year
Interest = ₹(15,660 x 16 x 1)/100
           = ₹2,505.60
           = ₹2,506 (corrected to the nearest rupee)
(iii) Hence, the interest for the second year is ₹2,506

8. Saurabh invests ₹48,000 for 7 years at 10% per annum compound interest. Calculate:
(i) the interest for the first year.
(ii) the amount at the end of second year.
(iii) the interest for the third year.
Solution:

For 1st year
P = ₹48,000; R = 10% and T = 1 year
Interest = ₹(48,000 x 10 x 1)/100
           = ₹4,800
(i) Hence, the interest for the first year is ₹4,800
And,
Amount = ₹48,000 + ₹4,800
           = ₹52,800
For 2nd year
P = ₹52,800; R = 10% and T = 1year
Interest = ₹(52,800 x 10 x 1)/100
           = ₹5,280
And,
Amount = ₹52,800 + ₹5,280 = ₹58,080

(ii) Hence, the amount at the end of second year is ₹58,080
For 3rd year
P = ₹58,080; R = 10% and T = 1year
Interest = ₹(58,080 x 10 x 1)/100
= ₹5,808
(iii) Hence, the interest for the third year is ₹5,808

9. Ashok borrowed ₹12,000 at some rate on compound interest. After a year, he paid back ₹4,000. If the compound interest for the second year is ₹920, find:
i. The rate of interest charged
ii. The amount of debt at the end of the second year
Solution:

(i) Let's assume x% to be the rate of interest charged
Then C.I, calculated
For 1st year
P = ₹12,000, R = x% and T = 1 year
Interest = (12,000 × x × 1)/100
= 120x
And, amount = ₹(12,000 + 120x)

For 2nd year
After a year, given that Ashok paid back ₹4,000.
P = (₹12,000 + ₹120x) - ₹4,000 = ₹(8,000 + 120x)
Interest = [(8,000 + 120x) × x × 1]/100
= ₹(80x + 1.20x^2)
But given,
The compound interest for the second year is ₹920
₹(80x + 1.20x^2) = ₹920
1.20x^2 + 80x - 920 = 0
3x^2 + 200x - 2300 = 0
3x^2 + 230x - 30x - 2300 = 0
x(3x + 230) -10(3x + 230) = 0
(3x + 230) (x - 10) = 0
x = -230/3 or x = 10
Since, the rate of interest cannot be negative
So, x = 10
Therefore, the rate of interest charged is 10%.

(ii) For 1st year:
Interest = ₹120x = ₹1200
For 2nd year:
Interest = ₹(80x + 1.20x^2) = ₹920

The amount of debt at the end of the second year is equal to the sum of the principal of the second year and interest for the two years.
Thus,
Total debt = ₹(8,000 + 1,200 + 920) = ₹10,120

10. On a certain sum of money, lent out at C.I., interests for first, second and third years are ₹1,500, ₹1,725 and ₹2,070 respectively. Find the rate of interest for the
(i) second year (ii) third year.
Solution:

Given,
The interest obtained in the first year is ₹1,500
The interest obtained in the second year is ₹1,750
Now,
(i) Difference between the interests of second year and first year is
= ₹1,725 - ₹1,500
= ₹225
So,
The rate of interest for the second year is calculated as
= (225/1,500) x 100
= 15%

Now,
(ii) Difference between the interests of third year and second year is
= ₹2,070 - ₹1,725
= ₹345
So,
The rate of interest for the second year is calculated as
= (345/1,725) x 100
= 20%

Therefore, the rates of interest for the second and third year are 15% and 20% respectively.