1. Calculate the amount and compound interest on

(a) ₹ 10800 for 3 years at 12 \( \frac{1}{2} \) % per annum compounded annually.

Solution:

Principal (P) = ₹ 10,800  
Rate (R) = 12 \( \frac{1}{2} \) % = \( \frac{25}{2} \) % (annual)  
Number of years (n) = 3

Amount, A = P \( \left(1 + \frac{R}{100}\right)^n\)  
= ₹ \(10800 \left(1 + \frac{25}{200}\right)^3\)  
= ₹ \(10800 \left(\frac{225}{200}\right)^3\)  
= ₹ 15377.34375  
= ₹ 15377.34 (approximately)

C.I. = A − P = ₹ (15377.34 − 10800) = ₹ 4,577.34

(b) ₹ 18000 for 2\( \frac{1}{2} \) years at 10% per annum compounded annually.

Solution:

Principal (P) = ₹ 18,000  
Rate (R) = 10% annual  
Number of years (n) = 2\( \frac{1}{2} \)

The amount for 2 years and 6 months can be calculated by calculating the amount for 2 years using the compound interest formula, and then calculating the simple interest for 6 months on the amount obtained at the end of 2 years.  
First, the amount for 2 years has to be calculated.

Amount, A = P \( \left(1 + \frac{R}{100}\right)^n\)  
= ₹ \(18000 \left(1 + \frac{1}{10}\right)^2\)  
= ₹ \(18000 \left(\frac{11}{10}\right)^2\)  
= ₹ 21780

By taking ₹ 21780 as principal, the S.I. for the next \( \frac{1}{2} \) year will be calculated.

S.I. = \(\frac{21780 \times \frac{1}{2} \times 10}{100}\) = ₹ 1089

∴ Interest for the first 2 years = ₹ (21780 − 18000) = ₹ 3780
And interest for the next \( \frac{1}{2} \) year = ₹ 1089
\[ \therefore \text{Total C.I.} = ₹ 3780 + ₹ 1089 = ₹ 4,869 \]
Amount, \( A = P + \text{C.I.} \)
\[ = ₹ 18000 + ₹ 4869 = ₹ 22,869 \]

(c) ₹ 62500 for \( 1\frac{1}{2} \) years at 8% per annum compounded half yearly.
Solution:

Principal (P) = ₹ 62,500
Rate = 8% per annum or 4% per half year
Number of years = \( 1\frac{1}{2} \)
There will be 3 half years in \( 1\frac{1}{2} \) years.
Amount, \( A = P \left(1 + \frac{R}{100}\right)^n \)
\[ = ₹ \left[62500 \left(1 + \frac{4}{100}\right)^3\right] \]
\[ = ₹ \left[62500 \left(\frac{104}{100}\right)^3\right] \]
\[ = ₹ \left[62500 \left(\frac{26}{25}\right)^3\right] \]
\[ = ₹ 70304 \]
C.I. = \( A - P = ₹ 70304 - ₹ 62500 = ₹ 7,804 \)

(d) ₹ 8000 for 1 year at 9% per annum compound half yearly.
(You could use the year by year calculation using SI formula to verify)
Solution:

Principal (P) = ₹ 8000
Rate of interest = 9% per annum or \( \frac{9}{2} \)% per half year
Number of years = 1 year
There will be 2 half years in 1 year.
Amount, \( A = P \left(1 + \frac{R}{100}\right)^n \)
\[ = ₹ \left[8000 \left(1 + \frac{9}{200}\right)^2\right] \]
\[ = ₹ \left[8000 \left(\frac{209}{200}\right)^2\right] \]
\[ = ₹ 8736.20 \]
C.I. = \( A - P = ₹ 8736.20 - ₹ 8000 = ₹ 736.20 \)

(e) ₹ 10000 for 1 year at 8% per annum compounded half yearly.
Solution:

Principal (P) = ₹ 10,000
Rate = 8% per annum or 4% per half year
Number of years = 1 year
There are 2 half years in 1 year.

Amount, A = P \left( 1 + \frac{R}{100} \right)^n
= ₹ \left[ \frac{10000 \left( 1 + \frac{4}{100} \right)}{2} \right]
= ₹ \left[ 10000 \left( 1 + \frac{1}{25} \right) \right]
= ₹ \left[ 10000 \left( \frac{26}{25} \right)^2 \right]
= ₹ 10816

C.I. = A - P = ₹ 10816 - ₹ 10000 = ₹ 816

2. Kamala borrowed ₹ 26400 from a Bank to buy a scooter at a rate of 15% p.a. compounded yearly. What amount will she pay at the end of 2 years and 4 months to clear the loan? (Hint: Find A for 2 years with interest is compounded yearly and then find SI on the 2nd year amount for \frac{4}{12} years.)

Solution:

Principal (P) = ₹ 26,400
Rate (R) = 15% per annum
Number of years (n) = 2 \frac{4}{12}

The amount for 2 years and 4 months can be calculated by first calculating the amount for 2 years using the compound interest formula, and then calculating the simple interest for 4 months on the amount obtained at the end of 2 years. First, the amount for 2 years has to be calculated.

Amount, A = P \left( 1 + \frac{R}{100} \right)^n
= ₹ \left[ 26400 \left( 1 + \frac{15}{100} \right)^2 \right]
= ₹ \left[ 26400 \left( 1 + \frac{3}{20} \right)^2 \right]
= ₹ \left[ 26400 \left( \frac{23}{20} \right) \right]^2
= ₹ 34914

By taking ₹ 34,914 as principal, the S.I. for the next \frac{1}{3} years will be calculated.

\text{S.I.} = \frac{34914 \times \frac{1}{3} \times 15}{100} = ₹ 1745.70

Interest for the first two years = ₹ (34914 - 26400) = ₹ 8,514
And interest for the next $\frac{1}{3}$ year = ₹1,745.70
Total C.I. = ₹(8514 + ₹1745.70) = ₹10,259.70
Amount = P + C.I. = ₹26400 + ₹10259.70 = ₹36,659.70

3. Fabina borrows ₹12,500 at 12% per annum for 3 years at simple interest and Radha borrows the same amount for the same time period at 10% per annum, compounded annually. Who pays more interest and by how much?

Solution:
Interest paid by Fabina = $\frac{P \times R \times T}{100}$
= $\frac{12500 \times 12 \times 3}{100}$
= ₹4500

Amount paid by Radha at the end of 3 years = $A = P \left(1 + \frac{R}{100}\right)^n$

= ₹[12500 \left(1 + \frac{10}{100}\right)^3]
= ₹16637.50

C.I. = A − P = ₹16637.50 − ₹12500 = ₹4,137.50
The interest paid by Fabina is ₹4,500 and by Radha is ₹4,137.50.
∴, Fabina pays more interest.
₹4500 − ₹4137.50 = ₹362.50
Hence, Fabina will have to pay ₹362.50 more.

4. I borrowed ₹12000 from Jamshed at 6% per annum simple interest for 2 years. Had I borrowed this sum at 6% per annum compound interest, what extra amount would I have to pay?

Solution:

P = ₹12000
R = 6% per annum
T = 2 years
S.I = $\frac{P \times R \times T}{100}$ = $\frac{12000 \times 6 \times 2}{100}$ = ₹1440

To find the compound interest, the amount (A) has to be calculated.
Amount, A = $P \left(1 + \frac{R}{100}\right)^n$

= ₹[12000 \left(1 + \frac{6}{100}\right)^2]
= ₹[12000 \left(1 + \frac{3}{50}\right)^2]
= ₹[12000 \left(\frac{53}{50}\right)^2]
= ₹13483.20

https://byjus.com
5. Vasudevan invested ₹ 60000 at an interest rate of 12% per annum compounded half yearly. What amount would he get
   i. after 6 months?
   ii. after 1 year?

Solution:

i. \( P = ₹ 60,000 \)
   \( \text{Rate} = 12\% \text{ per annum} = 6\% \text{ per half year} \)
   \( n = 6 \text{ months} = 1 \text{ half year} \)

Amount, \( A \)
\[
A = P \left(1 + \frac{R}{100}\right)^n
\]
\[
= ₹ \left[60000 \left(1 + \frac{6}{100}\right)^1\right]
\]
\[
= ₹ \left[60000 \left(1 + \frac{3}{50}\right)^1\right]
\]
\[
= ₹ \left[60000 \times \frac{53}{50}\right]
\]
\[
= ₹ 63600
\]

ii. There are 2 half years in 1 year.
   \( n = 2 \)

Amount, \( A \)
\[
A = P \left(1 + \frac{R}{100}\right)^n
\]
\[
= ₹ \left[60000 \left(1 + \frac{6}{100}\right)^2\right]
\]
\[
= ₹ \left[60000 \left(1 + \frac{3}{50}\right)^2\right]
\]
\[
= ₹ \left[60000 \times \frac{53}{50} \times \frac{53}{50}\right]
\]
\[
= ₹ 67416
\]

6. Arif took a loan of ₹ 80,000 from a bank. If the rate of interest is 10% per annum, find the difference in amounts he would be paying after 1\(\frac{1}{2}\) years if the interest is
   i. Compounded annually
   ii. Compounded half yearly

Solution:

i. \( P = ₹ 80,000 \)
   \( R = 10\% \text{ per annum} \)
   \( n = 1\frac{1}{2} \text{ years} \)

The amount for 1 year and 6 months can be calculated by first calculating the amount for
1 year using the compound interest formula, and then calculating the simple interest for 6 months on the amount obtained at the end of 1 year.

First, the amount for 1 year has to be calculated.

\[
A = P \left( 1 + \frac{R}{100} \right)^n
\]

\[
= ₹ \left[ 80000 \left( 1 + \frac{10}{100} \right) \right]
\]

\[
= ₹ \left[ 80000 \times \frac{11}{100} \right]
\]

\[
= ₹ 88000
\]

By taking ₹ 88,000 as principal, the SI for the next \( \frac{1}{2} \) year will be calculated.

\[
S.I. = \frac{P \times R \times T}{100} = \frac{88000 \times 10 \times \frac{1}{2}}{100} = ₹ 4400
\]

Interest for the first year = ₹ 88000 − ₹ 80000 = ₹ 8,000
And interest for the next \( \frac{1}{2} \) year = ₹ 4,400
Total C.I. = ₹ 8000 + ₹ 4,400 = ₹ 1,2400
\[
A = P + C.I. = ₹ (80000 + 12400)
\]

\[
= ₹ 92,400
\]

ii. The interest is compounded half yearly.
Rate = 10% per annum = 5% per half year
There will be three half years in 1\( \frac{1}{2} \) years.

\[
A = P \left( 1 + \frac{R}{100} \right)^n
\]

\[
= ₹ \left[ 80000 \left( 1 + \frac{5}{100} \right) \right]
\]

\[
= ₹ \left[ 80000 \times \frac{105}{100} \right]
\]

\[
= ₹ 92610
\]

Difference between the amounts = ₹ 92,610 − ₹ 92,400 = ₹ 210

7. Maria invested ₹ 8,000 in a business. She would be paid interest at 5% per annum compounded annually. Find.

i. The amount credited against her name at the end of the second year

ii. The interest for the 3rd year.

Solution:

i. \( P = ₹ 8,000 \)
\( R = 5\% \) per annum
\( n = 2 \) years

\[
A = P \left( 1 + \frac{R}{100} \right)^n
\]

\[
= ₹ \left[ 8000 \left( 1 + \frac{5}{100} \right)^2 \right]
\]
8. Find the amount and the compound interest on ₹ 10,000 for 1\frac{1}{2} years at 10% per annum, compounded half yearly. Would this interest be more than the interest he would get if it was compounded annually?

Solution:

P = ₹ 10,000
Rate = 10% per annum = 5% per half year
n = 1\frac{1}{2} years

There will be 3 half years in 1\frac{1}{2} years.

Amount, A = P \left(1 + \frac{R}{100}\right)^n
= ₹ \left[10000 \left(1 + \frac{5}{100}\right)^3\right]
= ₹ \left[10000 \times \left(\frac{105}{100}\right)^3\right]
= ₹ 11576.25

C.I. = A − P
= ₹ 11576.25 − ₹ 10000
= ₹ 1,576.25

The amount for 1 year and 6 months can be calculated by first calculating the amount for 1 year using the compound interest formula, and then calculating the simple interest for 6 months on the amount obtained at the end of 1 year.

The amount for the first year has to be calculated first.

Amount, A = P \left(1 + \frac{R}{100}\right)^n
= ₹ \left[10000 \left(1 + \frac{10}{100}\right)^1\right]
= ₹ \left[10000 \times \left(\frac{11}{10}\right)^1\right]
= ₹ 11000

By taking ₹ 11,000 as the principal, the S.I. for the next \frac{1}{2} year will be calculated.

S.I. = \frac{P \times R \times T}{100}
= \frac{11000 \times 10 \times \frac{1}{2}}{100}
= ₹ 550

\therefore \text{Interest for the first year} = ₹ 11000 − ₹ 10000 = ₹ 1000
\text{Total compound interest} = ₹ 1000 + ₹ 550 = ₹ 1,550
9. Find the amount which Ram will get on ₹ 4,096, he gave it for 18 months at $12\frac{1}{2}$ per annum, interest being compounded half yearly.

Solution:

\[ P = ₹ 4,096 \]
\[ R = 12\frac{1}{2} \text{ per annum} = \frac{25}{2} \text{ per annum} = \frac{25}{4} \text{ per half year} \]
\[ n = 18 \text{ months} \]

There will be 3 half years in 18 months. Therefore,

\[ \text{Amount, } A = P \left(1 + \frac{R}{100}\right)^n \]
\[ = ₹ 4096 \left(1 + \frac{25}{4 \times 100}\right)^3 \]
\[ = ₹ 4096 \times \left(1 + \frac{1}{16}\right)^3 \]
\[ = ₹ 4096 \times \left(\frac{17}{16}\right)^3 \]
\[ = ₹ 4913 \]

\[ \therefore \text{the required amount is } ₹ 4,913. \]

10. The population of a place increased to 54,000 in 2003 at a rate of 5% per annum

i. find the population in 2001

ii. what would be its population in 2005?

Solution:

i. It is given that, population in the year 2003 = 54,000

\[ 54000 = (\text{Population in 2001}) (1 + \frac{5}{100})^2 \]
\[ 54000 = (\text{Population in 2001}) \left(\frac{105}{100}\right)^2 \]
\[ 54000 = (\text{Population in 2001}) \left(\frac{105}{100} \times \frac{105}{100}\right) \]

Population in 2001 = \[ 54000 \times \frac{100}{105} \times \frac{100}{105} = 48979.59 \]

\[ \therefore \text{the population in the year 2001 was approximately 48,980.} \]

ii. (Population in 2005) = \[ 54000 \left(1 + \frac{5}{100}\right)^2 \]
\[ = 54000 \left(1 + \frac{1}{20}\right)^2 \]
\[ = 54000 \left(\frac{21}{20}\right)^2 \]
\[ = 59535 \]

\[ \therefore \text{the population in the year 2005 would be 59,535.} \]
11. In a laboratory, the count of bacteria in a certain experiment was increasing at the rate of 2.5% per hour. Find the bacteria at the end of 2 hours if the count was initially 5,06,000.

Solution:

The initial count of bacteria is given as 5,06,000.

Bacteria at the end of 2 hours = \( 506000 \left( 1 + \frac{2.5}{100} \right)^2 \)

= \( 506000 \left( 1 + \frac{1}{40} \right)^2 \)

= \( 506000 \left( \frac{41}{40} \right)^2 \)

= \( 531616.25 \)

∴, the count of bacteria at the end of 2 hours will be 5,31,616 (approx.).

12. A scooter was bought at ₹42,000. Its value depreciated at the rate of 8% per annum. Find its value after one year.

Solution:

Principal = Cost price of the scooter = ₹42,000
Depreciation = 8% of ₹42,000 per year

\[ \text{Depreciation} = \frac{P \times R \times T}{100} = \frac{42000 \times 8 \times 1}{100} = ₹3360 \]

Value after 1 year = ₹42,000 - ₹3360 = ₹38,640