SIMPLE AND COMPOUND INTEREST

- Introduction
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INTRODUCTION

Money is Not Free to Borrow: People can always find a use for money, so it costs to borrow money.

How much does it cost to borrow money?

Different places charge different amounts at different times!

But they usually charge this way: As a percent (per year) of the amount borrowed. It is called Interest.

Example: Borrow Rs. 1,000 from the Bank

Alex wants to borrow Rs. 1,000. The local bank says "10% Interest". So, to borrow the $1,000 for 1 year will cost:

Rs. 1,000 × 10% = Rs. 100

In this case the "Interest" is $100, and the "Interest Rate" is 10%

There are special words used when borrowing money, as shown here:

Alex is the Borrower; the Bank is the Lender.

The Principal of the Loan is $1,000.

The Interest is $100

What if Alex wanted to borrow the money for 2 Years?

If the bank charges "Simple Interest" then Alex just pays another 10% for the extra year.

Alex pays Interest of (Rs. 1,000 × 10%) x 2 Years = Rs. 200. That is how simple interest works…pay the same amount of interest every year

SIMPLE AND COMPOUND INTEREST

Principal: The money borrowed or lent out for a certain period is called the principal or the sum.

Interest:

Interest is the cost of borrowing money. An interest rate is the cost stated in Rs. as a percent per period, usually one year. Extra money paid for using other's money is called interest.

Simple Interest (S.I.):

Simple interest is calculated on the original principal only. Accumulated interest from prior periods is not used in calculations for the following periods. If the interest on a sum borrowed for certain period is reckoned uniformly, then it is called simple Interest i.e. the initial amount borrowed is the principal for the entire period of borrowing.

Simple Interest = $\frac{P \times T \times R}{100}$

P = principal (original amount borrowed or loaned)

R= interest rate for one period

T = number of periods

Example: A sum of money at simple interest amounts to Rs. 815 in 3 years and to Rs. 854 in 4 years. What is the sum?

Sol. S.I. for 1 year = Rs. (854 - 815) = Rs. 39

S.I. for 3 years = Rs. (39 x 3) = Rs. 117

Principal = Rs. (815 - 117) = Rs. 698

COMPOUND INTEREST

Compound interest is calculated each period on the original principal and all the accumulated interest during the past periods. Although the interest may be stated as a yearly rate, the compounding periods can be yearly, semi-annually, quarterly, or even continuously.

IMPORTANT FORMULA

Let Principal = P, Rate = R% per annum, Time = n year Rs.

When interest is compound Annually:

Amount = P $[1 + \frac{R}{100}]^n$

Example: Find compound interest on Rs. 7500 at 4% per annum for 2 years, compounded annually.

Solution: Amount = Rs. $7500 \times [1 + \frac{4}{100}]^2$
= Rs. (7500 x $\frac{26}{25}$ x$\frac{26}{25}$)
= Rs. 8112
C.I = Rs (8112 - 7500)
= Rs. 612

When interest is **compounded Half-yearly:**
Amount = P $[1 + \frac{R/2}{100}]^{2n}$
When interest is **compounded quarterly:**
Amount = P$[1 + \frac{R/4}{100}]^{4n}$
When interest is compounded annually but time is in fraction, say $3\frac{2}{5}$ year Rs.

Amount = P {$[1 + \frac{R}{100}]^3$ **+ (1 +**$\frac{\frac{2}{5} \times R}{100}$**)}**
When Rates are different for different years, say R_1%, R_2%, and R3% for 1st, 2nd and 3rd year respectively.
Amount= P {$(1 + \frac{R1}{100})(1 + \frac{R2}{100})$ $(1 + \frac{R3}{100})$**}**
Depreciation of Value
Due to wear and tear the value of machine or any other article keeps decreasing every year. This decrease is called depreciation.
Value (V) = Vo$[1 - \frac{R}{100}]^n$
Where, Vo = Initial Value of Article

Example: A school buys a minibus for R 950 000, which depreciates at 13.5%P.A. Determine the value of the minibus after 3 year Rs.
Sol. Vo = 950000 I = 13.5% N = 3
V = $950000\left[1 - \frac{13.5}{100}\right]^3$
V = $950000[1 - .135]^3$
= Rs. 614853.89
What is Year 0?
Year 0 is the year that starts with the "Birth" of the Loan, and ends just before the 1st Birthday.

Just like when a baby is born its age is zero, and will not be 1 year old until the first birthday.

So the start of Year 1 is the "1st Birthday". And we can know the start of Year 5 is exactly when the loan is 5 Years

Old.

Remember the rules:

If it is simple interest, just work out the interest for one period, and multiply by the number of periods.

If it is compound interest, work out the interest for the first period, add it on and then calculate the interest for the next period, etc.

PRACTICE PROBLEMS (EXPLANATORY ANSWERS AT THE END)

1. A man took a loan from a bank at the rate of 12% p.a. simple interest. After 3 years he had to pay Rs.5400 interest only for the period. The principal amount borrowed by him was
A. Rs.2000 B. Rs.10, 000
C. Rs.15, 000 D. Rs.20, 000

2. How much time will it take for an amount of Rs. 450 to yield Rs. 81 as interest at 4.5% per annum of simple interest?
A. 3.5 years B. 4 years
C. 4.5 years D. 5 years

3. A sum fetched a total simple interest of Rs.4016.25 at the rate of 9% per annum in 5 years. What is the sum?
A. Rs.4462.50 B. Rs.8032.50
C. Rs.8900 D. Rs.8925

4. A sum of Rs.12, 500 amounts to Rs.15, 500 in 4 years at the rate of simple interest. What is the rate of interest?
A. 3% B. 4% C. 5% D. 6%

5. The simple interest on Rs.1820 from March 9, 2003 to May 21, 2003 at $7\frac{1}{2}$ % rate will be
A. Rs.22.50 B. Rs.27.30
C. Rs.28.80 D. Rs.29

6. A sum of money at simple interest amounts to Rs.815 in 3 years and to Rs.854 in 4 years. The sum is:
A. Rs.650 B. Rs.690
C. Rs.698 D. Rs.700

7. Divya took a loan of Rs.1200 with simple interest for as many years as the rate of interest. If she paid Rs.432 as interest at the end of the loan period, what was the rate of interest?
A. 3.6% B. 6%
C. 18% D. cannot be determined

8. Find compound interest on Rs. 7500 at 4% per annum for 2 years, compounded annually.
A. Rs.512 B. Rs.552
C. Rs.612 D. Rs.622

9. Find the compound interest on Rs.16, 000 at 20% per annum for 9 months, compounded quarterly.
A. Rs.2522 B. Rs.2512
C. Rs.2572 D. Rs.2592

10. Albert invested an amount of Rs.8000 in a fixed deposit scheme for 2 years at compound interest rate 5 % per annum. How much amount will Albert get on maturity of the fixed deposit?
A. Rs.8600 B. Rs.8620
C. Rs.8840 D. Rs.8820

11. The present worth of Rs.169 due in 2 years at 4% per annum compound interest is
A. Rs.150.50 B. Rs.154.75
C. Rs.156.25 D. Rs.158

12. The difference between simple interest and compound on Rs.1200 for one year at 10% per annum reckoned half-yearly is:
A. Rs.2.50 B. Rs.3
C. Rs.3.75 D. Rs.4

13. A bank offers 5% compound interest calculated on half-yearly basis. A customer deposits Rs.1600 each on 1st January and 1st July of a year. At the end of the year, the amount he would have gained by way of interest is:
A. Rs.120 B. Rs.121
C. Rs.122 D. Rs.123

14. The effective annual rate of interest corresponding to a nominal rate of 6% per annum payable half-yearly is:
A. 6.06% B. 6.07%
C. 6.08% D. 6.09%

15. 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. Rs.1550 B. Rs.1650
C. Rs.1750 D. Rs.2000

SOLUTION WITH EXPLNATORY ANSWER

1. Principal = Rs. (100×5400 / 12×3)
‹=› Rs. 15,000.
Ans: Option C

2. Time = (100* 81)/(450*4.5) = 4 years
Ans: Option B

3. Principal = Rs. (100×4016.25 / 9×5)
‹=› Rs. (401625/45)
‹=› Rs. 8925.
Ans: Option D

4. S.I. = Rs. (15500 - 12500)
= Rs. 3000.
Rate = (100×3000 / 12500×4)%
= 6%.
Ans: Option D

5. Time = (22+30+21) days
‹=›73 days.
‹=› 1/5 year.
S.I= Rs. (1820×15/2×1/5×1/100)
‹=›Rs. 27.30.
Ans: Option B

6. S.I. for 1 year = Rs. (854 - 815) = Rs. 39.
S.I. for 3 years = Rs.(39 x 3) = Rs. 117.
Principal = Rs. (815 - 117) = Rs. 698.
Ans: Option C

7. Let rate = R% and time = R years.
Then, 1200 x R x R= 432

12R2 = 432
R2 = 36
R = 6.
Ans: Option B

8. Amount= Rs[7500x(1+4/100)²]
=Rs. (7500x26/25x26/25)
= Rs.8112.
C.I = Rs (8112 - 7500)
=Rs.612.
Ans: Option C

9. Principal= Rs.16,000;
Time=9 months= 3 quarters;
Amount =Rs.[16000x(1+5/100)³]
=[16000x21/20x21/20x21/20]
= Rs.18522.
C.I = Rs.(18522 - 16000)
= Rs.2522.
Ans: Option A

10. Amount=Rs.[8000x(1+5/100)²]
= Rs. [8000 x 21/20x21/20]
= Rs. 8820.
Ans: Option D

11. Present Worth = Rs.[169/(1+4/100)²]
= Rs.(169x25/26x25/26)
= Rs.156.25
Ans: Option C

12.

$$\text{S.I. of Rs} = \left(1200 \times 10 \times \frac{1}{100}\right) = \text{Rs. } 120.$$

$$\text{C.I. of Rs.} = \left[1200 \times \left(1 + \frac{5}{100}\right)^2 - 1200\right] = \text{Rs. } 123.$$

Difference: Rs. 123-120 = Rs.3
Ans: Option B

13.

$$\text{Amount} = \text{Rs.} \left[1600 \times \left(1 + \frac{5}{2 \times 100}\right)^2 + 1600 \times \left(1 + \frac{5}{2 \times 100}\right)\right]$$

$$= \text{Rs.} \left[1600 \times \frac{41}{40} \times \frac{41}{40} + 1600 \times \frac{41}{40}\right]$$

$= \text{Rs.} \left[1600 \text{ x } \frac{41}{40}\left(\frac{41}{40} + 1\right) \right]$

$= \text{Rs.} \left[\frac{1600 \text{ x } 41 \text{ x } 81}{40 \text{ x } 40} \right]$

= Rs. 3321.

Ans: Option B

14.

Amount of Rs. 100 for 1 year when compounded half-yearly $= \text{Rs.} \left[100 \text{ x } \left(1 + \frac{3}{100}\right)^2 \right] = \text{Rs. } 106.09$

Therefore, effective rate = 6.09 %

Ans: Option D

15. C.I.=Rs[4000x(1+10/100)²-4000]
Rs.(4000x11/10x11/10-4000) = Rs.940.
Sum =Rs. [420x100 /3x8]
= Rs.1750.

Ans: Option C