SIMPLE AND COMPOUND INTEREST

When a person has to borrow some money as a loan from his friends, relatives, bank etc. He promises to return it after a specified time period along with some extra money for using the money of the lender. The money borrowed is called the **Principal**, usually denoted by P, and the extra money paid is called the **Interest**, usually denoted by I. The total money paid back, that is, the sum of Principal and the Interest is called the **Amount**, and is usually denoted by A.

Thus, $A = P + I$

P is the money deposited or borrowed called the PRINCIPAL.

T is the TIME or number of years for which the money is deposited or borrowed.

The interest is calculated at a RATE per cent decided by the bank every year. This is R % p.a. (per annum or per year)

There are two types of interests.

1. Simple Interest (S.I.).
2. Compound Interest (C.I.).

Simple Interest (S.I.): If the interest on a sum borrowed for certain period is reckoned uniformly, and then it is called simple interest.

Let Principal = P, Rate = R% per annum (p.a.) and Time = T years. Then

(i). Simple Interest = $\left(\frac{P \times R \times T}{100}\right)$

(ii). $P = \left(\frac{100 \times S.I.}{R \times T}\right)$; $R = \left(\frac{100 \times S.I.}{P \times T}\right)$ and $T = \left(\frac{100 \times S.I.}{P \times R}\right)$.

(iii) Relationship between principal and amount is:

$$P = \frac{100 \times Amount}{100 + RT}$$

Note: The Simple Interest (SI) remains the same every year.

Generally if C.I. is not mention, then we assume S.I.

Shortcut tricks

1. If sum of money becomes (z times) in (T) years at simple interest, then rate of interest (R) can be calculated using the formula:

Rate of Interest (R) % = 100 (z – 1) / T

2. If sum of money becomes (z times) at rate of interest (R) % per annum at simple interest, then time (T) can be calculated using the formula:

Time (T) = 100 (z – 1) / R

3. If in any numerical, the time given is specified in months, then convert it into years by simply dividing number of months by 12. If time is given in days, then convert days into year by dividing it with 365.

a) S.I. = (P × R × M) / 1200

(Here rate of interest is given in percent and time in months (M))

b) S.I. = (P × R × D) / 36500

(Here rate of interest is given in percent and time in days (D))

4. At what R% p.a., will a sum of money becomes n times in T years

R = [(n-1)*100]/T

5. A certain sum, becomes m times in T1 years and n times in how many years
Required Time =(n-1)*T1/(m-1)
6. The annual payment not will discharge a debt of Rs.A, due in T years at R% P.A., On S.I.
Annual Payment= (200 A) / [T{200+R(T-1)}]

Example 1: A sum of money at simple interest amounts to Rs. 815 in 3 years and to Rs. 854 in 4 years. The sum is?

Solution: 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.

Example 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?

Solution:

$$\text{Time} = \left(\frac{100 \times 81}{450 \times 4.5}\right)\text{years} = 4 \text{ years.}$$

Example 3: A sum of Rs. 12,000 amounts to Rs. 15,000 in 4 years at the rate of simple interest. Find the rate of interest.

Solution: A Sum of Rs. 12,000 amounts to Rs. 15,000 in 4 years, at the rate of simple interest.
This means that the after 4 years, the principal amount increases to Rs. 15000.
Therefore,
S.I. = Rs. 15000 – Rs. 12000
S.I. = Rs. 3000
Rate of Interest = (100 × S.I.) / (P × T)
= (100 × 3000) / (12000 × 4)
= 6.25 %
Rate of Interest = 6.25 %

Example 4: What annual payment discharges a debt of Rs. 12900, due in 4 yrs. At 5% rate

Solution: A.P. = (200X12900) / [4(200+5X3)]=3000
Alternative
100+105+110+115=12900
430=12900
100=12900/(430)X100=3000

Compound Interest: Compound Interest is the interest calculated on the initial principal and the accumulated interest of previous periods of a deposit or loan. In easy words, it can be said as "interest on interest".

The formula for Compound Amount (A)
$= P [1+ R/100]^{n}$ [When money is compounded annually]
$= P [1+ R/(2*100)]^{2n}$ [When money is compounded half-yearly]
$= P [1+ R/(4*100)]^{4n}$ [When money is compounded quarterly]
$= P [1+ R/(12*100)]^{12n}$ [When money is compounded monthly]
Also, A = CI + P
Where,
P= Principal, R= Rate of Interest, n=Time (in years), A= Amount, CI= Compound Interest

Note: The above formula: A = CI + P will give us total amount. To get the Compound Interest only, we need to subtract the Principal from the Amount.
The interest for the first month is same in both Simple Interest and Compound Interest. From second month, the interest starts changing.

Shortcut Tricks

1. Numerical on population:
a) If population of a city is P1 and it increases by R % annually, then population after n years is given by: $P_2 = P_1 [1 + R/100]^n$
b) If population of a city is P1 and it decreases by R % annually, then the population after n years is given by: $P_2 = P_1 [1 – R/100]^n$
2. If interest is compounded annually and time is in fraction say 2 (3/5) years
Amount = $P [1 + R/100]^2 * [1 + (3/5)R/100]$
[Interest compounded annually]
3. When Rates are different for different years, say R1%, R2%, R3% for 1st, 2nd and 3rd year respectively.
Then, Amount = P [1 +R1/100] [1+R2/100] [1+R3/100].
4. Present worth of Rs. x due n years hence is given by:
Present Worth = x / [1+R/100]
5. Difference between Compound Interest & Simple interest Concept
For Two years
CI – SI =P(r/100)^2
For Three Year
CI – SI =P(r^2/(100^2))×(300+r)/100)
6. Rule of 72: This rule is used to find:
a) Time required for an amount to double itself, at a given rate of interest.
Time = 72/Rate of interest
b) Rate at which an amount doubles itself in given time.
Rate of interest = 72/Time

Example 5: Find the amount if Rs 20000 is invested at 10% p.a. for 3 years.
Solution: Using the formula: $A= P [1+ R/100]^n$
$A = 20000 [1 + (10/100)]^3$
On Solving, we get A = Rs. 26620

Example 6: Find the CI, if Rs 1000 was invested for 1.5 years at 20% p.a. compounded half yearly.
Solution: As it is said that the interest is compounded half yearly. So, the rate of interest will be halved and time will be doubled.
$CI = P [1+(R/100)]^n - P$
$CI = 1000 [1 + (10/100)]^3 - 1000$
On Solving, we get
CI = Rs. 331

Example 7: The CI on a sum of Rs 625 in 2 years is Rs 51. Find the rate of interest.
Solution: We know that A = CI + P
A = 625 + 51 = 676

Now going by the formula: $A = P [1+(R/100)]^n$
$676 = 625 [1+(R/100)]^2$
$676/625 = [1+(R/100)]^2$
We can see that 676 is the square of 26 and 625 is the square of 25
Therefore, $(26/25)^2 = [1+(R/100)]^2$
$26/25 = [1+(R/100)]$
$26/25 - 1 = R/100$
On solving, R = 4%

Example 8: A sum of money is put on CI for 2 years at 20%. It would fetch Rs 482 more if the interest is payable half yearly than if it were payable yearly. Find the sum.

Solution: Let the Principal = Rs 100
When compounded annually,
A = 100 [1+20/100]^2
When compounded half yearly,
A = 100[1+10/100]^4
Difference, 146.41 - 144 = 2.41
If difference is 2.41, then Principal = Rs 100
If difference is 482, then Principal = 100/2.41 × 482
P = Rs 20000.

Example 9: Manish invested a sum of money at CI. It amounted to Rs 2420 in 2 years and Rs 2662 in 3 years. Find the rate percent per annum.

Solution: Last year interest = 2662 - 2420 = Rs 242
Therefore, Rate% = (242 * 100)/(2420 * 1)
R% = 10%

Example 10: The difference between SI and CI for 2 years @ 20% per annum is Rs 8. What is the principal?

Solution: Using the formula: Difference = P (R/100)^2
8 = P[20/100]^2
On Solving, P = Rs 200

LEVEL – I

1. How much time will it take for an amount of Rs. 900 to yield Rs. 81 as interest at 4.5% per annum of simple interest?
A. 2 years B. 3 years C. 1 year D. 4 years

2. Arun took a loan of Rs. 1400 with simple interest for as many years as the rate of interest. If he paid Rs.686 as interest at the end of the loan period, what was the rate of interest?
A. 8% B. 6% C. 4% D. 7%

3. 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. 700 B. Rs. 690 C. Rs. 650 D. Rs. 698

4. A sum fetched a total simple interest of Rs. 929.20 at the rate of 8 p.a. in 5 years. What is the sum?
A. Rs. 2323 B. Rs. 1223 C. Rs. 2563 D. Rs. 2353

5. What will be the simple interest on Rs. 80,000 at 16(2/3) % per annum for 9 months?
A. 8,000 B. 9,000 C. 10,000 D. 11,000

6. Find the simple interest on Rs. 5000 at 6 % per annum for the period from 5th Feb to 19th April, 2018?
A. Rs. 40 B. Rs. 50 C. Rs. 60 D. Rs. 70

7. Suresh borrows Rs. 10,000 for 2 years at 4 % p.a. simple interest. He lends it to Ramesh at 6 % p.a. for 2 years. Find his gain in this transaction per year.
A. Rs. 150 B. Rs. 200 C. Rs. 400 D. Rs. 450

8. At what rate percent per annum will sum of money double in 20 years?
A. 1.2 % B. 2 % C. 4 % D. 5 %

9. John took a loan of Rs. 1500 with simple interest for as many years as the rate of interest. If he paid Rs. 540 as interest at the end of loan period, what was the rate of interest?
A. 2 % B. 3 % C. 4 % D. 6 %

10. What will be the ratio of simple interest earned by certain amount at the same rate of interest for 5 years and that for 15 years?
A. 3 : 2 B. 1 : 3 C. 2 : 3 D. 3 : 1

11. What is the difference between the compound interests on Rs. 5000 for 1 (1⁄2) years at 4% per annum compounded yearly and half-yearly?
A. Rs. 2.04 B. Rs. 4.80 C. Rs. 3.06 D. Rs. 8.30

12. The difference between simple and compound interests compounded annually on a certain sum of money for 2 years at 4% per annum is Re. 1. The sum is:
A. Rs.600 B. Rs.645 C. Rs.525 D. Rs.625

13. The compound interest on Rs. 30,000 at 7% per annum is Rs. 4347. The period (in years) is:
A. 1 B. 2 C. 3 D. 3.5

14. There is 80% increase in an amount in 8 years at simple interest. What will be the compound interest of Rs. 14,000 after 3 years at the same rate?
A. Rs.3794 B. Rs.3714 C. Rs.4612 D. Rs.4634

15. The population of a city increases 5 % annually but decreases by 1/4 % due to emigration. Find the net increase in percent in 3 years.
A. 8.63 % B. 11.89 % C. 13.25 % D. 14.93 %

16. Find the compound interest on Rs. 5000 for 9 months at 6% per annum, if the interest is reckoned quarterly.
A. Rs. 218.98 B. Rs. 228.39 C. Rs. 250.69 D. Rs. 356.50

17. Find compound interest on Rs. 8500 at 4 % per annum for 2 years, compounded annually.
A. Rs. 752.6 B. Rs. 693.6 C. Rs. 553.6 D. Rs. 593.6

18. A amount of Rs. 500 amounts to Rs. 583.20 in two years if compounded annually. Find the rate of interest per annum.
A. 5.6 % B. 6 % C. 8 % D. 9.2 %

19. A sum of money doubles itself at compound interest in 10 years. In how many years will it be eight times?
A. 30 years B. 28 years C. 25 years D. 22.5 years

20. The difference between C.I. and S.I. on a certain sum at 10 % per annum for 2 years is Rs. 530. Find the sum.
A. 53000 B. 57500 C. 69800 D. 28090

LEVEL – II

1. Mr. Thomas invested an amount of Rs. 13,900 divided in two different schemes A and B at the simple interest rate of 14% p.a. and 11% p.a. respectively. If the total amount of simple interest earned in 2 years be Rs. 3508, what was the amount invested in Scheme B?
A. Rs. 6400 B. Rs. 7200 C. Rs. 6500 D. Rs. 7500

2. A sum of Rs. 12,000 amounts to Rs. 15,000 in 4 years at the rate of simple interest. Find the rate of interest?
A. 6.25 % B. 4.25 % C. 5.9 % D. 5 %

3. Nikhil borrowed some money at the rate of interest 5 % p.a. for first 2 years, 8 % p.a. for next 5 years and 10 % p.a. for a period beyond 7 years. If he pays total interest of Rs. 8000 at the end of 10 years, then find the money Nikhil borrowed?
A. Rs. 40,000 B. Rs. 35,000 C. Rs. 25,000 D. Rs. 10,000

4. A sum was put at simple interest at a certain rate for 2 years. Had it been put at 2 % higher rate, it would have fetched Rs. 400 more. Find the sum?
A. 8000 B. 9000 C. 10000 D. 12000

5. The S.I. on a certain sum of money for 4 years at 15 % per annum is Rs. 180 more than S.I. on same sum for 5 years at 10 % per annum. Find the sum.
A. 1000 B. 1200 C. 1800 D. 2000

6. A sum of money amounts to Rs.9800 after 5 years and Rs.12005 after 8 years at the same rate of simple interest. The rate of interest per annum is?
A. 15% B. 12% C. 8% D. 5%

7. A man took loan from a bank at the rate of 8% p.a. simple interest. After 4 years he had to pay Rs. 6200 interest only for the period. The principal amount borrowed by him was:
A. Rs.17322 B. Rs.20245 C. Rs.18230 D. Rs.19375

8. A man deposited Rs. 400 for 2 years, Rs. 550 for 4 years and Rs. 1200 for 6 years. He received Rs. 1020 at the
A. 8% B. 10% C. 15% D. 20%

9. A person invests money in three different schemes for 6 years, 10 years and 12 years at 10%, 12% and 15% simple interest respectively. At the completion of each scheme, he gets the same interest. The ratio of his investments is:
A. 2 : 3 : 4 B. 3 : 4 : 2 C. 3 : 4 : 6 D. 6 : 3 : 2

10. Simple interest on Rs. 500 for 4 years at 6.25% per annum is equal to the simple interest on Rs. 400 at 5% per annum for a certain period of time. The period of time is:
A. 6(1/4) B. 7 C. 8 D. 4(1/4)

11. The value of a sewing machine depreciates at the rate of 10 % after every year. If at the end of 3 years, its value is Rs. 8748, then find its purchase price.
A. 8000 B. 10000 C. 12000 D. 15000

12. A certain sum amounts to Rs. 7000 in 2 years and to Rs. 8000 in 3 years. Find the sum.
A. Rs. 6959.37 B. Rs. 6459.37 C. Rs. 5359.37 D. Rs. 5759.37

13. The compound interest on a certain sum at 50/3 % for 3 years is Rs. 127. Find simple interest on same sum for same period and rate.
A. Rs. 205 B. Rs. 175 C. Rs. 152 D. Rs. 108

14. If the simple interest on a sum of money for 2 years at 5% per annum is Rs. 60, what is the compound interest on the same at the same rate and for the same time?
A. Rs. 63.5 B. Rs. 62 C. Rs. 61.5 D. Rs. 64

15. The least number of complete years in which a sum of money put out at 20% compound interest will be more than doubled is
A. 5 B. 4 C. 4 D. 2

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

17. Simple interest on a certain sum of money for 4 years at 5% per annum is half the compound interest on Rs. 3000 for 2 years at 10% per annum. The sum placed on simple interest is:
A. Rs.1575 B. Rs. 2200 C. Rs. 1200 D. Rs. 1625

18. The compound interest on a certain sum for 2 years at 10% per annum is Rs. 525. The simple interest on the same sum for double the time at half the rate percent per annum is:
A. Rs. 500 B. Rs. 400 C. Rs. 450 D. Rs. 600

19. The Compound interest on Rs. 20,480 at 6 1⁄4 % per annum for 2 years 73 days, is?
A. Rs. 2929 B. Rs. 2219 C. Rs. 3021 D. Rs. 3049

20. A sum of money is borrowed and paid back in two annual instalments of Rs. 882 each allowing 5% compound interest. The sum borrowed was:
A. Rs.1820 B. Rs.1640 C. Rs.1260 D. Rs.1440