22. Simple interest and Compound interest

In the case of simple interest:
(1) The principal remains the same for every year.
(2) The interest for any two years remains constant.
(3) Amount increases linearly.

In the case of compound interest:
(1) The amount at the end of a year is the principal for the consecutive year.
(2) The interest for different years is not the same.
(3) The compound interest for the first year (when compounded annually) is equal to the simple interest for one year.
(4) Amount increases exponentially.

Taking principal as Rs100 and rate of interest as 10% p.a. he / she has to fill in the table by actively involving the students.

	Under Simple Interest				Under Compound interest			
Year	Principal at the beginning of the year	Interest for the year the year	Interest till the end of the year	Amount at the end of the year	Principal at the beginning of the year	Interest for the year	Interest till the end of the year	Amount at the end of the year
1	100	10	10	110	100	10	10	110
2	100	10	20	120	110 1	1	21	121
3	100	10	30	130	121	12.1	33.1	133.1
4	100	10	40	140	133.1	13.31	46.41	146.41

1. Find the Simple interest on Rs.15000 for 3 years at 10% p.a.

Sol: The interest on Rs.15000 for 1 year at 10% p.a is Rs1500. For three years the interest is = 3 x 1500 = Rs 4500.

2. Find the simple inter est on Rs.18000 for 2 years 8 months at 12.5% p.a.

3. A sum of money lent out at simple interest amounts to Rs.800 in 2 years and Rs.1250 in 5 years. Find the sum and the rate of interest.

Sol: Let the principal be Rs P and the interest for one year be Rs. I.
Amount for two years,
i.e., P + 2 I = Rs. 800.
And P + 5 I = Rs.1250.
By solving I = Rs.150 and P = Rs.500.

$$\text{Rate of interest} = \frac{150}{500} \times 100 = 30\% \text{ p.a.}$$

4. At what rate of simple interest will a sum become four times itself in 30 years?

Sol: Let the principal be Rs.100.
$\therefore$ The amount after 30 years is Rs. 400.
$\therefore$ Interest = Rs.300

$$\text{i.e., } \frac{PTR}{100} = 300$$

$$\frac{100 \times 30 \times R}{100} = 300$$

R = 10% p.a.

5. In six years a certain sum doubles itself, under simple interest. In how many years will the sum become three times of itself?

Sol: Let the principal be Rs.100.
$\therefore$ The amount after 6 years is Rs.200.
Interest = 100.
Time taken to earn interest (which is 100% of the principal) is 6 years.
Time taken to earn interest, (which is 200% the principal) is $\frac{6}{100}$ x 200 = 12 years.

6. A sum amounts to Rs.11520 in 2 years at 20% p.a. compounded annually. Find the sum.

Sol: Let the principal be Rs.100.
R = 20%
Amount after 1 year will be Rs.120.

$$\text{Amount after 2 years is } 120 \times \frac{120}{100} = \text{Rs } 144$$

Given, amount after 2 years is Rs.11520

P	A
100	144
?	11520

$\therefore$ The principal = $\frac{11520 \times 100}{144}$ = Rs. 8000

7. In what time will Rs.4000, amount to Rs. 5324 at 10% p.a., which is compounded annually?

Sol: Given, P = Rs. 4000 R = 10%, A =Rs.5324

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

$$5324 = 4000\left(1+\frac{10}{100}\right)^n$$

$$\Rightarrow \frac{1331}{1000} = \left(\frac{11}{10}\right)^n \Rightarrow \left(\frac{11}{10}\right)^3 = \left(\frac{11}{10}\right)^n$$

$\Rightarrow$ n = 3

$\therefore$ In 3 years the sum of Rs. 4000 amounts to Rs. 5324.

8. A sum of money doubles at compound interest in 6 years. In how many years will it become 8 times itself?

Sol: Given that $p\left(1+\frac{r}{100}\right)^6 = 2p$

$$\Rightarrow \left(1+\frac{r}{100}\right)^6 = 2$$

$$\left(1+\frac{r}{100}\right) = 2^{\frac{1}{6}}$$

Let the sum become 8 times itself in n years.

$p\left(1+\frac{r}{100}\right)^n = 8p$ $\Rightarrow \left(1+\frac{r}{100}\right)^n = 8$

$\Rightarrow \left(2^{\frac{1}{6}}\right)^n = 2^3$ $\Rightarrow$ n = 18 years.

Alternative method:

Compound interest increases exponentially with a linear increase in the time period.

To become 2 times, it takes 6 years,

To become 8 (23) times, it takes 6x3=18 years.

9. Find the difference between the simple interest and compound interest (compounded annually) on Rs.25,000 at 20% p.a. for 2 years.

Sol: Difference between CI and SI for 2 years is

$$p\left(\frac{r}{100}\right)^2 = 25000\left(\frac{20}{100}\right)^2 = 1000$$

$\therefore$ The difference between C.I. and S.I. is Rs.1000.

Growth and Depreciation:

For finding growth in population, percentage of increase in cost of goods, percentage of decrease in the value of assets successively, the concept of compound interest has to be applied.

While considering growth, value after growth is,

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

For decrease, the value after decrease is,

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

Where, P is the original value, R is the rate of growth and n is the time period in years.

$\therefore$ Growth = G - P ; Decrease = P - D

If the rate of growth is R1% for the first year, R2% for the second year…….. and Rn% for the nth year, then the value at the end of n years is given by

$$A = P\left(1+\frac{R_1}{100}\right)\left(1+\frac{R_2}{100}\right).....\left(1+\frac{R_n}{100}\right)$$

10. The population of a city increases at the rate of 10% per annum. Find the population of the city in the year after 3 years if its present population is 3 crores.

Sol: $\therefore$ Population after n years = $P\left(1+\frac{R}{100}\right)^n$

$$= P\left(1+\frac{10}{100}\right)^3 = 30000000\left(\frac{11}{10}\right)^3 = 39930000$$

$\therefore$ The population is 3,99,30,000.

11. The value of a car decreases every year at the rate of 15% over that of the previous year. If its present value is Rs 50000, then find its value at the end of two years.

Sol: Present value of car = Rs 50000

Rate of depreciation = 15%

Value of the car at the end of two years

$$= 50000\left(\frac{85}{100}\right)\left(\frac{85}{100}\right) = \text{Rs. } 36125.$$

Practice exercise

1. What would a sum of Rs.8800 amount to in 16 years at a simple interest rate of 12% every year?

(1) Rs.14440 (2) Rs.18846

(3) Rs.25696 (4) Rs.32322

2. A person invested a sum of Rs.750 in a bank at simple interest. After 5 years he received Rs.1200.

Find the rate of interest offered by the bank.
(1) 10% p.a. (2) 11% p.a.
(3) 20% p.a. (4) 12% p.a.

3. A sum of money invested at simple interest amounts to Rs.2480 at the end of four years and Rs.4080 at the end of eight years. Find the principal.
(1) Rs.2040 (2) Rs.1480
(3) Rs.1240 (4) Rs.880

4. Kumar borrowed a certain sum at 12% p.a. simple interest for 8 years. At the end of 8 years he paid Rs.14112 to clear the debt. What is the sum he borrowed?
(1) Rs.6800 (2) Rs.6600
(3) Rs.7000 (4) Rs.7200

5. A sum of money triples itself in 4 years at compound interest, interest compounded annually. In how many years it becomes 27 times of itself?
(1) 36 (2) 64 (3) 12 (4) 10

6. A sum triples itself in three years at simple interest. In how many years will the same sum become nine times itself at the same rate?
(1) 18 (2) 9 (3) 24 (4) 12

7. A sum lent at 24% p.a. simple interest yields Rs.200 more interest than when lent at 20% p.a. compound interest in two years. Find the sum.
(1) 3500 (2) 5000 (3) 4200 (4) 4000

8. Snehal borrowed certain sum from a moneylender at 10% p.a. under simple interest for 2 years. But he was asked to pay under compound interest calculated annually at same rate, due to which he had to pay Rs.350 extra. Find the sum borrowed by Snehal.(in Rs.)
(1) 3500 (2)35000 (3)30000 (4)25000

9. A. A certain sum amounts to Rs. 49500 in 5 years and Rs. 57000 in 8 years at certain rate of interest under simple interest. Find the sum.
(1) 39000 (2) 37500 (3)37000
(4) Data insufficient

B. In the above question, what is the rate of interest (approximately)?
(1) 6 (2) 5 (3) 7 (4) 8

10. A certain sum amounts to Rs. 192000 in 5 years & Rs. 243000 in 7 years at certain rate of interest under compound interest compounded yearly. what is the rate of interest perannum?
(1) 12.5% (2)10% (3) 8%
(4) 9.25% (5) can't be found

11. The interest on a certain sum lent at compound interest, the interest being compounded annually, in the 2nd year is Rs.1200. The interest on it in the 3rd year is Rs.1440. Find the rate of interest per annum.
(1) 10% (2) 15% (3) 20% (4) 25%

12. A certain sum when lent at compound interest, the interest being compounded annually, amounts to Rs.1331 in 3 years and Rs.1464.10 in 4 years. Find the rate of interest per annum.
(1) 10% (2) 15% (3) 20% (4) 5%

13. A sum of money becomes Rs.1694 in 5 years and Rs.2016 in 7 years at compound interest, compounded annually. Find rate of interest.
(1) $9\frac{1}{11}$ p.a. (2) 10% p.a.
(3) $11\frac{1}{9}$ % p.a. (4) 8% p.a.

14. A sum doubles in 8 years at simple interest. In how many years will the sum become 4 times the original sum?
(1) 16 (2) 24 (3) 64 (4) 32

15. A sum doubles in 8 years at compound interest. In how many years will the sum become 4 times the original sum if the interest is compounded annually?
(1) 16 (2) 24 (3) 64 (4) 32

16. Ashok has to deposit a total of Rs.18000 in two savings schemes of a bank, of which the first one yields a simple interest of 6% p.a. and the second one yields 8% p.a. simple interest. How much should Ashok deposit in the first scheme so that the total amount deposited earns interest at a rate of 7.6% p.a.?
(1) Rs.4400 (2) Rs.3600
(3)Rs.7200 (4) Rs.5600

17. The difference between the interest earned under compound interest, interest being compounded annually and simple interest for two years on the same sum and at the same rate of interest is Rs.25.60. Find the sum if the rate of interest is 8% p.a.
(1) Rs.2000 (2) Rs.2500
(3) Rs.3200 (4) Rs.4000

18. Raju took a loan at 8% per annum simple interest for a period of 5 years. At the end of five years he paid Rs.10640 to clear his loan. How much loan did he take?
(1) Rs.8500 (2) Rs.8000
(3) Rs.7700 (4) Rs.7600

19. A man deposited a certain amount in a fixed deposit at r% p.a., interest being compounded annually. If the interest accrued for the fourth and fifth years are Rs.26620 and Rs.29282, what is the total interest accrued for the first three years?
(1) Rs.66000 (2) Rs.66200
(3) Rs.72600 (4) Rs.79860

20. A certain sum, at compound interest, yields Rs.1260 and Rs.1512 for the third and fourth years respectively. Find the sum.
(1) Rs.4500 (2) Rs.4375
(3) Rs.4650 (4) Rs.4425

Simple interest & Compound interest							
1	3	**6**	4	**11**	3	**16**	2
2	4	**7**	2	**12**	1	**17**	4
3	4	**8**	2	**13**	3	**18**	4
4	4	**9**	3,3	**14**	2	**19**	2
5	3	**10**	1	**15**	1	**20**	2