SIMPLE INTEREST

Simple Interest

SI is nothing but the fixed percentage of the principal (invested/borrowed/amount of money).

Some key words

- Principal (P) : It is the sum of money deposited/loaned e.t.c. also known as "Capital".
- □ **Interest :** It is the money paid by the borrower, calculated on the basis of Principal.
- □ **Time (T/n) :** This is the duration for which money is lent/borrowed.
- □ **Rate of Interest (r/R) :** It is the rate at which the interest is charged on principal.

Amount (A) = Principal + Interest

Some Basic Formulae

□ Simple Interest (SI):

 $SI = \frac{P \times R \times T}{100}$

P = Principal, r = rate of interest (in %) t = time period (yearly, half yearly etc.)

$$\therefore \text{ Amount (A)} = P + SI = P + \frac{p r t}{100} = P$$

$$\left(1+\frac{rt}{100}\right)$$

Some Useful Short-cut Methods :

 If a certain sum in T years at R % per annum amounts to Rs. A, then the sum will be

$$P = \frac{100' A}{100 + (R' T)}$$

2. If a certain sum is invested in n types of investments in such a manner that equal amount is obtained on each investment where interest rates are R_1 , R_2 , R_3 ,Rn respectively and time periods are T_1 , T_2 , T_3 ,Tn respectively, then the ratio in which the amounts are invested is :

 $\frac{1}{100 + R_1 T_1} : \frac{1}{100 + R_2 T_2} : \frac{1}{100 + R_3 T_3} : \dots \frac{1}{100 + R_n T_n}$

3. If a certain sum of money becomes n times itself in T years at simple interest, then the rate of interest per annum is

$$R = \frac{100(n-1)}{T}\%$$

4. If a certain sum of money becomes n times itself in T years at a simple interest, then the time T in which it will become m times itself is given by

$$\Gamma' = \frac{(m-1)}{(n-1)} \times T$$

 Effect of change of P, R and T on simple interest is given by the following formulae : Change in Simple Interest

Product of fixed parameters x

[difference of variable parameters] For example, if rate (R) changes

from R_1 to R_2 and P and T are fixed, then

Change in S.I. =
$$\frac{\text{PT}}{100} \times (\text{R}_1 - \text{R}_2)$$

Similarly, if principal (P) changes from P_1 to P_2 and R and T are fixed, then change in

S.I. =
$$\frac{RT}{100}$$
 (P₁-P₂)

Also, if rate (R) changes from R_1 to R_2 and time (T) changes from T_1 to T_2 but principal (P) is fixed, then change in

S.I. =
$$\frac{P}{100} \times (R_1 T_1 - R_2 T_2)$$

6. If a certain sum of money P lent out at S.I. amounts to A_1 in T_1 years and to A_2 in T_2 years, then

$$\mathbf{P} = \frac{A_1 T_2 - A_2 T_1}{T_2 - T_1}$$

and, R =
$$\frac{A_1 - A_2}{A_2 T_1 - A_1 T_2} \times 100$$

7. If a sum P_1 lent at simple interest rate of $R_1^{\,0}$ per annum and another sum P_2 at simple interest rate of $R_2^{\,0}$ per annum, then the rate of interest for the whole sum is :

$$\mathbf{R} = \left(\frac{P_1 R_1 + P_2 R_2}{P_1 + P_2}\right)$$

8. When there is a change in principal (P), rate (R) and time (T), then the value of simple interest (I) also changes and is given by

$$\frac{I_1}{I_2} = \frac{P_1 \times R_1 \times T_1}{P_2 \times R_2 \times T_2}$$

$$\Rightarrow \frac{A_1 - P_1}{A_2 - P_2} = \frac{P_1 \times R_1 \times T_1}{P_2 \times R_2 \times T_2}$$

$$I_1 = A_1 - P_1 \text{ and } I_2 = A_2 - P_2$$

9. Out of a certain sum P,
$$\frac{1}{a}$$
 part is

invested at R₁%, $\frac{1}{b}$ part at R₂% and the remainder $\left(1-\frac{1}{a}-\frac{1}{b}\right)$ say $\frac{1}{c}$ part at R₃%. If the annual income from all these investments is Rs A, then the original sum is given by

$$P = \left(\frac{A \times 100}{\frac{R_1}{a} + \frac{R_2}{b} + \frac{R_3}{c}}\right)$$

 A Sum of Rs. 4000 is lent for 5 years at the rate of 15% per annum. Find the interest.
 (a) Rs. 3000 (b) Rs. 2000
 (c) Rs. 1000 (d) Rs. 1500

(e)None of these

Sol. (a) S.I = $\frac{P' R' T}{100}$ P @ 4000 R @ 15% T @ 5 years

So, S.I. = $\frac{4000' \ 15' \ 5}{100}$ = Rs.3000

Alternate

Here, r = 15%

t = 5 years

Therefore the interest will be $(15\times5) = 75\%$ of the sum

Thus, Interest =
$$\frac{4000'\ 75}{100}$$

= Rs. 3000

- 2. If the simple interst on Rs. 625 increases by Rs. 25 when the time increases by 2 years. Find the rate percent per annum.
 (a) 2%
 (b) 3%
 - (c) 1% (d) 0.5%
 - (e) None of these
- Sol. (a) Here, the extra interest

 $\underset{e}{\overset{x}{\xi}} \frac{25}{625}$, $100 \frac{\ddot{o}}{\dot{z}} = 4\%$ of the sum.

Since, the increased time is two years therefore the extra interest would be $(2 \times r)\%$ of the sum (where r is the rate of interest)

Now,

□ r = 2%

3.

- A man deposits Rs. 1350 in a bank at 5% per annum and Rs. 1150 in another bank at 6% per annum. Find the rate of interest for the whole sum.
 (a) 5.40% (b) 6.40%
 - (c) 5.46% (d) 111%
- (e)None of these
- Sol. (c) Here the ratio of investments is 1350 : 1150 = 27 : 23

Now, using Alligation method



Where x is the rate of interest for the whole sum.

Now,
$$x = \frac{5^{\prime} 27 + 6^{\prime} 23}{(27 + 23)}$$

$$= \frac{(135+138)}{50} = \frac{273}{50}$$
$$= 5.46\%$$

4. The simple interest on a sum of money is $\frac{4}{9}$ of the principal, and the number of years is equal to the rate per cent per annum. Find the rate per cent.

(a)
$$6\frac{2}{3}\%$$
 (b) $5\frac{5}{5}\%$
(c) $7\frac{2}{3}\%$ (d) $6\frac{1}{3}\%$

- (e) None of these
- Sol. (a) From the given statement in the question part we can conclude that ratio of sum and interest is 9: 4.
- and, Rate % = Time = x

In the above case interest is x^2 % of the sum i.e.

$$= \frac{9' x^2}{100} = 4$$

$$x^2 = \frac{4' 100}{9}$$

$$x = \frac{20}{3} = 6\frac{2}{3}$$

Thus, the required rate of
interest is $6\frac{2}{3}\%$

- 5. If the simple interest on Rs. 1350 be more than the interest on Rs. 1250 by Rs. 20 in 2 years, find the rate percent per annum.
 - (a) 5% (b) 10%
 - (c) 6% (d) 8%

$$\begin{array}{c} \downarrow \\ 2 \text{ years} & --20 \\ 1 \text{ year} & --10 \\ R = \frac{10}{100} \times 100 \end{array}$$

Alternate

We know that Rs. 20 is the interest for 2 years on the sum (1350–1250) = Rs. 100

Hence, the required rate of Interest = $\frac{20'\ 100}{100'\ 2}$ = 10%

- 6. If the simple interest on Rs. 375 increases by Rs. 75, when the rate % increases by 5% per annum. Find the time.
 - (a) 2 years (b) 8 years
 - (c) 4 years (d) 9 years
 - (e) None of these
- Sol. (c) Here the extra interest = Rs.

75 Rate =
$$\frac{75}{375}$$
' 100 = 20% of the sum.

Now, we have $5 \times t = 20$

$$t = \frac{20}{5} = 4 \text{ years}$$

- 7. What annual installment will discharge a debt of Rs. 4,200 due in 5 years at 10% simple interest?
 (a) Rs. 700 per year
 (b) Rs. 350 per year
 (c) Rs. 750 per year
 (d) Rs. 650 per year
 (e) None of these
- Sol. (a) Installment =

$$\frac{Principal \times 100}{100 \times t + (t_{n-1} + t_{n-2} + t_{n-3.....} +) \times R\%}$$

$$P = 4200$$

$$T = 5 \text{ years}$$

$$R\% = 10\%$$
then According to the question

We can conclude that $(2 \times r)\% = 4\%$

Installment

$$= \frac{4200' \ 100}{100' \ 5 + (4 + 3 + 2 + 1)' \ 10}$$
$$= \frac{4200' \ 100}{600} = \text{Rs. } 700$$

8. In what time does a sum of money become thrice at the simple interest rate of 8% per annum?

(a) 30 years(b) 15 years(c) 20 years(d) 25 years(e) None of these

Sol. (d) T =
$$\frac{1}{R} \times 100$$

= $\frac{3-1}{8} \times 100$
= $\frac{2}{8} \times 100 = 25$ years

Alternate

Here, the ratio of the sum and the amount is 1: 3 Therefore, the ratio of the sum and the interest would be 1: 2 Now, we have Amount = 3 Principal = 1 Interest = 2 Rate = 8% Time = ?

Note that the interest is $\underbrace{\overset{\alpha}{\xi}}_{i}^{2} \underbrace{\overset{}_{1}}_{g}^{i} 100^{\ddot{o}}_{\pm}_{g}^{i}$

= 200% of the sum. Now, we get $8 \times t = 200$

 $t = \frac{200}{8} = 25$ years

A certain sum is invested for a certain time period. It amounts to Rs. 400 at 10% per annum.But when invested at 4% per annum, it amounts to Rs. 200. Find the time.

(a) 100 years (b) 75 years

- (c) 50 years (d) 60 years
- (e) None of these
- Sol. (c) Assume Time = T years According to the question,

$$P\left(1+\frac{10t}{100}\right)=400$$
(i)

$$P\left(1+\frac{4t}{100}\right)=200$$
(ii)

2t = 100

$$t = 50$$
 years

- 10. Ramesh borrows Rs.7000 from a bank after 3 years he returns Rs.3000 and after 5 years by returning Rs.5450 closes the account. Find the rate of interest :
 - (a) 5 % (b) 4%
 - (c) 2% (d) 6%
- Sol. (a) Actual P = Rs.7000 Total money returned = Rs.8450
 - S.I. = Rs.1450

SI of 3 years on 7000 will be Equal to SI of 1 year on 21000 SI of 2 years on 4000 will be Equal to SI of 1 year on 8000 21000 + 8000 = 29000

$$\frac{29000 \times R \times 1}{100} = 1450$$

11. A sum was put on SI at a certain rate for 3 years. Had it been put at 4% higher rate, it would have fetched Rs. 600 more, Find the sum.
(a) Rs. 5000 (b) Rs. 4000 (c) Rs. 6000 (d) Rs. 3000 (e) None of these
Sol. (a) Extra Interest = 4 × 3 = 12%

Hence, sum =
$$\frac{600}{12} \times 100$$

- = Rs. 5000
- 12. A certain sum of money amounts to Rs. 550 in 3 years and to Rs. 650 in 4 years. Find the sum.
 - (a) Rs. 250 (b) Rs. 300 (c) Rs. 150 (d) Rs. 350 (e) None of these (a) Amount for 3 years
- Sol. (a) Amount for 3 years = Rs. 550

- Amount for 4 years = Rs.650 SI for 1 year = Rs.100 Then, SI for 3 years = 300 Therefore, sum 550 - 300 Sum = Rs. 250
- 13. A sum was put at SI at a certain rate for 4 years. Had it been put at 5% lower rate, it would have fetched Rs. 100 less. Find the sum.
 - (a) Rs. 500 (b) Rs. 5000

(c) Rs. 400 (d) Rs. 4000

Sol. (a) According to the question, Rs. 100 is (4 \times 5=) 20% of the sum.

Hence, sum =
$$\frac{100'\ 100}{20}$$
 = Rs. 500

14. Anish borrowed Rs. 15000 at the rate of 12% and another amount at the rate of 15% for two years. The total interest paid by him was Rs. 9000. How much did he borrow?

(a) Rs. 32000 (b) Rs. 33000

(c) Rs. 30000 (d) Rs. 63000

(e) None of these

Sol. (b) Here,

$$\frac{15000' 12' 2}{100} + \frac{x' 15' 2}{100} = 9000$$
$$3600 + \frac{3}{10} x = 9000$$
$$x = \frac{(9000 - 3600)' 10}{3}$$
$$= \frac{5400' 10}{3} = \text{Rs. } 18000$$

Hence the total borrowed amount=15000+18000=Rs. 33000

- 15. At a certain rate of simple interest Rs. 400 amounted to Rs. 460 in 3 years. If the rate of interest is decreased by 3%, what will be the amount after 3 years?
 - (a) Rs. 424 (b) Rs. 484
 - (c) Rs. 242 (d) Rs. 484
 - (e) None of these

Sol. (a) S.I = Rs. 400 $\frac{3 \text{ years}}{3\%}$ 460

(amount)

Interest = $\frac{400' 9\%}{100}$ = Rs. 36

New amount required = 460 -36 = Rs. 424

Alternate

The required new amount

 $= 460 - (3 \times 3)\%$ of 400 = 460 - 36 = Rs. 424

16. Rs. 1,200 amounts to Rs. 1,632 in 4 years at a certain rate of simple interest. If the rate of interest is increased by 1%, it would amount to how much? (a) Rs. 1635 (b) Rs. 1644 (c) Rs. 1670 (d) Rs. 1680 (e) None of these

Sol. (d) Rs. 1200
$$\frac{4 \text{ years}}{+1\%}$$
 Rs.1632
Interest = 1200 × (4×1)%
= Rs.48
The required new amount
= 1632 + 48 = Rs. 1680

Alternate

The required new amount

= 1632 + (4 × 1)% of 1200

- = 1632 + 48 = Rs. 1680
- 17. The simple interest on a sum of money will be Rs. 150 after 4 years. In the next 4 years principal becomes 5 times, what will be the total interest at the end of the 8th year?
 - (a) Rs. 950 (b) Rs. 850 (c) Rs. 900 (d) Rs. 860 (e) None of these
- Sol. (c) In 4 Years

P @ Rs. 150

In next four Years

Principal = 5×150

Total Interest at the end of 8 vears = 750 + 150 = Rs. 900

Alternate

- Total interest at the end of 8 years $= 150 + 5 \times 150 = \text{Rs}.900$
- 18. The simple interest on a sum of money will be Rs. 225 after 3 years. In the next 5 years principal becomes 3 times what will be the total interest at the end of the 8th year?
 - (a) Rs. 1250 (b) Rs. 1330
 - (c) Rs. 1360 (d) Rs. 1350
 - (e) None of these
- Sol. (d) Sum
 - Time Interest Ρ 3 years Rs. 225 Ρ Rs. 75 1 year 3P 1 year Rs. 225

3P Rs. 1125 5 years Hence the total interest at the end of 8

years would be 225 + 1125 = Rs. 1350 19. A sum of Rs. 1521 is lent out in two parts in such a way that the interest on one part at 10% for 5 years is equal to that on another part at 8% for 10 years. Find the two sums. (a) Rs. 926, Rs. 595 (b) Rs. 906, Rs. 615 (c) Rs. 916, Rs. 605 (d) Rs. 936, Rs. 585 (e) None of these

Sol. (d) Total
$$\rightarrow$$
 1521
 $P \times 10\% \times 5$ $P \times 8\% \times 10$
 $\frac{P}{P} = \frac{8}{5}$
13 Units = Rs. 1521
1 Unit = Rs.117
 $P_1 \otimes 8 \times 117 = Rs.936$
 $P_2 \otimes 5 \times 117 = Rs.585$
20. A sum of money becomes
times at the simple int

les two times at the simple interest rate of 2% per annum. At what rate per cent will it become five folds? (a) 10% (b) 8%

(c) 6% (d) 9% (e) None of these

Sol. (b)
$$T = \frac{times}{R} \times 100 = \frac{2-1}{2} \times 100$$

T = 50 years

 $R\% = \frac{5-1}{50} \times 100 = 8\%$

21. A certain sum of money amounts to Rs. 5000 in 5 years at 10% per annum. In how many years will it amount to Rs. 6000 at the same rate? (a) 8 years (b) 6 years (c) 10 years (d) 9 years

(e) None of these

Sol. (a) Here the amount = Rs. 5000is $(100 + 5 \times 10)\%$ of the sum. Therefore, the amount = Rs. 6000

> would be $\xi_{\frac{150}{6}000}^{\frac{150}{2}}$ 6000 = $\frac{\ddot{o}}{\pm}_{\frac{1}{9}180\%}$ of sum where interest is equal to 80% of the sum Thus we get $10 \times t = 80$

 \Box t = 8 years

22. What principal will amount to Rs. 560 in 3 years at rate of 4 percent per annum simple interest?

> (a) Rs. 540 (b) Rs. 500

- (c) Rs. 550 (d) Rs. 560
- (e) None of these
- Sol. (b) Total interest = $(100 + 3 \times 4)\%$ Hence, sum = $\frac{560'\ 100}{112}$ = Rs. 500

- 23. A person lent a certain sum of 4% simple money at interest, and in 5 years the interest amounted to Rs. 520 less than the sum lent. Find the sum lent.
 - (a) Rs. 600 (b) Rs. 650
 - (c) Rs. 700 (d) Rs. 750
 - (e) None of these
- Sol. (b) Here Rs. 520 is $(100 4 \times 5)\%$ of the sum.

Hence sum = $\frac{520'\ 100}{20}$ = Rs. 650

24. A sum of money double itself in 5 years. It will become 4 times itself in

> (a) 10 years (b) 12 years

> (d) 20 years (c) 15 years

(e) None of these

Sol. (a)
$$\frac{T_1}{T_2} = \frac{n_1 - 1}{n_2 - 1}$$

 $\frac{T_1}{5} = \frac{4 - 1}{2 - 1}$

 $T_1 = 15$ years

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the universities in simple inference in the sum at 4% per annum for 3 years and at 5% per annum for 2 years is Rs. 50. Find the sum.
(a) Rs. 5000 (b) Rs. 4000