## SSC \& Railways Exams

## SI \& CI Short Tricks PDF

## Quantitative Notes on Simple Interest

Simple Interest $(\mathrm{SI})=\frac{P \times R \times T}{100}$
Amount: Amount is total sum of Principal and simple Interest.
where $\mathbf{P}=$ principal,
$\mathbf{R}(\%)=$ rate of interest per annum,()
$\mathrm{T}=$ time period (in years)
So, $\mathrm{P}=\frac{S I \times 100}{R \times T} ; \mathrm{R}=\frac{S I \times 100}{P \times T} ; \mathrm{T}=\frac{S I \times 100}{P \times R}$

Example 1: What will be the rate of interest if the principal is Rs. 2500 and simple interest for 3 years is Rs 375?
Solution: Given, Principal $=2500, \mathrm{~T}=3 \mathrm{yrs}, \mathrm{SI}=375$
So, $\mathrm{R}=\frac{S I \times 100}{P \times T}$

$$
R=\frac{375 \times 100}{2500 \times 3}=5 \%
$$

Without formula: Simple interest for 3 years is 375 , Interest for 1 year is Rs. 125
Now we can calculate rate of interest $=\frac{\text { Interst } \text { for } 1 \text { year }}{\text { Principal }} \times 100$

$$
=\frac{125}{2500} \times 100=5 \%
$$

Example 2: If the principal is 100 Rs. The difference of Simple Interest for 4 yrs and $6 y r s$ is Rs 8. Calculate the rate of simple interest.
Solution: In simple interest questions, interest always remains same for a year if the principal, rate of interest is constant for the same.
Let Interest for 4 yrs is I then interest for 6 yrs is ( $\mathrm{I}+8$ )
interest for 2 yrs is Rs. 8
interest for $1 \mathrm{yr}=4$
rate of interest $=(4 / 100) \times 100=4 \%$

Example 3: If the amount is (10/9) times of Principal and rate of interest and time both are numerically equal. Then, what is the rate of interest per annum?
Solution: Let Principal is P. Given, numerically $\mathrm{R}=\mathrm{T}$
Interest $=$ Amount - principal
$\mathrm{I}=(10 / 9) \mathrm{P}-\mathrm{P}$
$\mathrm{I}=\mathrm{P} / 9$ (Interest is in the multiples of Principal)
Now, $\mathrm{I}=[(\mathrm{P} \times \mathrm{R} \times \mathrm{T}) / 100]$
$\mathrm{P} / 9=(\mathrm{P} \times \mathrm{R} \times \mathrm{T}) / 100$
$R^{2}=100 / 9$ (using, $R=T$ )
$R=(10 / 3) \%$
We can also say the time period is (10/3)years.
Short approach: Whenever Interest is in multiple of Principal and Rate of Interest and Time period is equal.
Then, $\mathrm{R}=\mathrm{T}=\sqrt{100 \times \text { multiple of } P}$
$R=T=\sqrt{100 \times(1 / 9)}=10 / 3$

## Annual Instalments for Simple Interest:

## Let's discuss a real example to understand instalments concept:

A person deposit Rs. 140 to the bank every year up to 5 years. The bank gives him 5\% rate of interest simple annually. And at the end of 5 years he get total amount of Rs. 770
So, 140 is the instalment, time is 5 years rate of interest is $5 \%$ and the amount or debt is Rs. 770 This Instalment is also known as the annual payment. Debt is total amount, so don't confuse between these two terms.

Installment $=\frac{100 A}{100 t+r t \frac{(t-1)}{2}}$ where $\mathrm{A}=$ debt, $\mathrm{r}=$ rate of interest and $\mathrm{t}=$ time period

Example 4: What annual payment will discharge a debt of Rs. 848 in $4 y r s$ at $4 \%$ per annum simple interest?
Solution: Given, $A=848, r=4 \%$ and $t=4 y r s$
Using formula: Annual payment $=\frac{100 \times 848}{100 \times 4+4 \times 4 \frac{(4-1)}{2}}$
Annual payment $=\frac{100 \times 848}{400+24}=200$
In case if you forget formula then how to approach this question.
Let installment is $X$. There are 4 installments and rate of interest is also $4 \%$
Debt $(A)=$ four installments $+(r \%) \times$ installments $\times(0+1+2+\ldots(t-1))$
So, $848=4 X+(4 \%)(X)(0+1+2+3)$
$848=4 X+$
$848=4 X+$
$848=424 X / 100$
$X=200$

## Some Important examples based on Simple Interest.

Example 5: A sum amounts to Rs. 702 in 2 years and Rs. 783 in 3 years. Calculate the sum, rate of interest and the amount after 5 years?

## Solution:

Amount for 2 years $\left(A_{2}\right)=702$
Amount for 3 years $\left(A_{3}\right)=783$
Interest for 1 year $(\mathrm{I})=783-702=81$
So Sum $=\mathrm{A}_{2}-2 \mathrm{I}=702-2 \times 81=702-162=540$
rate of interest $=(81 / 540) \times 100$

$$
=15 \%
$$

Amount after 5 years $=$ Sum +5 I

$$
\begin{aligned}
& =540+5 \times 81 \\
& =945
\end{aligned}
$$

Example 6: A sum of money doubles itself in 3 yrs at a simple interest. In how many yrs will it amount to 8 times itself?
Solution: Doubles in 3 yrs
3 times in $3 \times 2=6 y r s$
4 times in $3 \times 3=9 y r s$
8 times in $3 \times 7=21 \mathrm{yrs}$
Example 7: Atul and Vijay are friends. Atul borrowed a sum of Rs. 400 at $5 \%$ per annum simple interest from Vijay. He returns the amount with interest after 2 yrs. Vijay returns to Atul 2\% of the total amount returned. How much did Atul receive?
Solution: After 2 yrs, amount returned to Vijay $=400+(400 * 5 * 2) / 100=$ Rs 440
Amount returned to Atul $=2 \%$ of $440=8.8$
Example 8: Rs. 4000 is divided into two parts such that if one part be invested at $3 \%$ and the other at $5 \%$, the annual interest from both the investments is Rs. 144. Find each part.
Solution: Let the amount lent at $3 \%$ rate be Rs. $X$, then amount lent at $5 \%$ rate is $4000-X$
So, $3 \%$ of $X+5 \%$ of $(4000-X)=144$
$5 \%$ of $4000-2 \%$ of $X=144$
$200-2 \%$ of $X=144$
$2 \%$ of $X=56$
$X=(56 / 2) \times 100$
$X=2800$
and $4000-X=1200$.

## How to solve this Question by Alligation Method:

First, we will calculate the net rate of interest for Rs. 144 on 4000
So, net rate $=(144 / 4000) \times 100=3.6 \%$
Apply allegation:

| part1 part 2 |  |
| :---: | :---: |
| \% | 5 |
| 5-3.6 | 3.6-3 |
| $=1.4$ | =0.6 |
| 7 | : 3 |

So part 1 : part2 $=7: 3$
part1 $=(7 / 10) \times 4000=2800$
part2 $=(3 / 10) \times 4000=1200$

## Quantitative Notes on Compound Interest

Now, Let's discuss the basic difference between Simple Interest and Compound Interest.
Principal $=1000$, rate of interest $(r)=10 \%$, time $=3 y r s$

## Simple Interest

SI for $1^{\text {st }} \mathrm{yr}=(1000 \times 10 \times 1) / 100=100$,
SI for $2^{\text {nd }} \mathrm{yr}=100$ (In SI it will be the same as $1^{\text {st }} \mathrm{yr}$ )
SI for $3^{\text {rd }} \mathrm{yr}=100$

## Compound Interest:

CI for $1^{\text {st }} \mathrm{yr}=100$
CI for $2^{\text {nd }} \mathrm{yr}$ will not be same as $1^{\text {st }} \mathrm{yr}$ because principal for $2^{\text {nd }} \mathrm{yr}$ is the amount of $1^{\text {st }} \mathrm{yr}$.
So, CI $\left(2^{\text {nd }} \mathrm{yr}\right)=(1100 \times 10 \times 1) / 100=110$
CI for $3^{\text {rd }} \mathrm{yr}$ will also not be the same as $1^{\text {st }} \mathrm{yr}$ and $2^{\text {nd }} \mathrm{yr}$ because principal for $3^{\text {rd }} \mathrm{yr}$ is the amount of $2^{\text {nd }} \mathrm{yr}$.
principal ( $3^{\text {rd }} \mathrm{yr}$ ) $=$ Amount ( $2^{\text {nd }} \mathrm{yr}$ ) $=$ Principal ( $2^{\text {nd }} \mathrm{yr}$ ) + Interest $\left(2^{\text {nd }} \mathrm{yr}\right)=1100+110=1210$
CI $\left(3^{\text {rd }} \mathrm{yr}\right)=(1210 \times 10 \times 1) / 100=121$
Hence total CI for 3yrs $=100+110+121=331$
Amount after 3 yrs = 1331
Interest is always calculated on the Principal. But in case of CI, Principal is get changed every year. If we calculate it by net rate concept then the Principal will remain same.

## Concept 1 : How to calculate net CI rate for 2 years?

Let rate is r\% per annum for 2 years
Net CI rate for $2 y r s$ can be calculated by $=2 r+\left(r^{2} / 100\right)$
If rate is $1 \%$, net CI rate for $2 y r s=2 \times 1+\left(1^{2} / 100\right)=2.01 \%$
If rate is $3 \%$, net CI rate for $2 y r s=2 \times 3+\left(3^{2} / 100\right)=6.09 \%$
If rate is $14 \%$, net CI rate for $2 y r s=2 \times 14+\left(14^{2} / 100\right)=29.96 \%$
We suggest you to learn the table given below:

| \% Rate per <br> annum | Net CI rate for <br> $\mathbf{2}$ yrs | \% Rate per <br> annum | Net CI rate for <br> $\mathbf{2}$ yrs |
| :---: | :---: | :---: | :---: |
| $2 \%$ | $4.04 \%$ | $9 \%$ | $18.81 \%$ |
| $3 \%$ | $6.09 \%$ | $10 \%$ | $21 \%$ |
| $4 \%$ | $8.16 \%$ | $11 \%$ | $23.21 \%$ |
| $5 \%$ | $10.25 \%$ | $12 \%$ | $25.44 \%$ |
| $6 \%$ | $12.36 \%$ | $13 \%$ | $27.69 \%$ |
| $7 \%$ | $14.49 \%$ | $14 \%$ | $29.96 \%$ |
| $8 \%$ | $16.64 \%$ | $15 \%$ | $32.25 \%$ |

## Concept 2 : How to calculate net CI rate for 3 years?

Let rate is r\% per annum for 3 years
Net CI rate for 3yrs can be calculated $=3 r+3\left(r^{2} / 100\right)+\mathbf{1}\left(r^{3} / 10000\right)$
If rate is $3 \%$ p.a., net CI rate for 3 yrs
$=\mathbf{3} \times 3+\mathbf{3}(9 / 100)+\mathbf{1}(27 / 10000)$
$=9+.27+.0027=9.2727$
If rate is $12 \%$ p.a., net CI rate for 3 yrs
$=3 \times 12+3(144 / 100)+1(1728 / 10000)$
$=36+4.32+.1728$
$=40.4928$
Representation while calculating net rate \%.
Let's calculate it for the rate $3 \%$ p.a.
write, $r / r^{2} / r^{3}=3 / 9 / 27$
then, $3 r / 3 r^{2} / 1 r^{3}=9 / 27 / 27$
$=9.2727$
We suggest you learn the table given below:

| \% Rate per <br> annum | Net CI rate for <br> $\mathbf{3}$ yrs | \% Rate per <br> annum | Net CI rate for <br> $\mathbf{3}$ yrs |
| :---: | :---: | :---: | :---: |
| $1 \%$ | $3.31 \%$ | $6 \%$ | $19.1016 \%$ |
| $2 \%$ | $6.1208 \%$ | $7 \%$ | $22.5043 \%$ |
| $3 \%$ | $9.2727 \%$ | $8 \%$ | $25.9712 \%$ |
| $4 \%$ | $12.4864 \%$ | $9 \%$ | $29.5029 \%$ |
| $5 \%$ | $15.7625 \%$ | $10 \%$ | $33.10 \%$ |

Concept 3 : If the r\% p.a. is in fraction:
Example: if the rate is $16(2 / 3) \%$ and the principal is 216 , then calculate CI for $2 y r s$ and $3 y r s$.
Solution: We can write $16(2 / 3) \%=1 / 6$ (Discussed in percentage study notes)
For 2 years
$216 \times(1 / 6)=36$, Now multiply 36 by $2=72$
$36 \times(1 / 6)=6$, multiply 6 by $1=6$
Add both the above value $=72+6=78$
CI for $2 y r s=78$
For 3 years
$216 \times(1 / 6)=36$, Now multiply 36 by $3=108$
$36 \times(1 / 6)=6$, multiply 6 by $3=18$
$6 \times(1 / 6)=1$, multiply 1 by $1=1$
Add all the above values $=(108+18+1)=127$
CI for 3yrs = 127

Concept 4 : When r\% is given p.a. and CI has to be calculated half-yearly or quarterly basis.

| Yearly | factor | r\% (per annum) | Time (n yrs) |
| :---: | :---: | :---: | :---: |
| Half yearly | 6months $=(6 / 12)$ <br> $=1 / 2$ | Factor $\times \mathrm{r} \%=(\mathrm{r} / 2) \%$ | 2 n |
| Quarterly | 3months $=(3 / 12)=1 / 4$ | $(1 / 4) \times \mathrm{r} \%=(\mathrm{r} / 4) \%$ | 4 n |
| 9 months | 9months $=(9 / 12)=$ <br> $3 / 4$ | $(3 / 4) \times \mathrm{r} \%=(3 \mathrm{r} / 4) \%$ | $4 \mathrm{n} / 3$ |
| 8 months | 8 months $=(8 / 12)=$ <br> $2 / 3$ | $(2 / 3) \times \mathrm{r} \%=(2 \mathrm{r} / 3) \%$ | $3 \mathrm{n} / 2$ |

Example: If $\mathrm{r} \%=10 \%$ per annum. Find the CI on 5000 for 2 years if it is compounded half-yearly.
Solution: Rate is calculated half yearly so new $r \%=(10 / 2) \%=5 \%$
Given time is 2 yrs , acc.to half yearly, it will be $2 \times 2=4$
Now we have to calculate CI for 4yrs @ $5 \%$
We know $5 \%=(1 / 20)$
So, $5000 \times(1 / 20)=250$, multiply 250 by $4=1000$
$250 \times(1 / 20)=12.5$, multiply 12.5 by $6=75$
$12.5 \times(1 / 20)=0.625$, multiply 0.625 by $4=2.5$
$0.625 \times(1 / 20)=.03125$ multiply .03125 by $1=.03125$
Add all the above values
$(1000+75+2.5+0.03125)=1077.53125$
Concept 5 : When different rates are given for 2 years.
If $a \%$ is given for $1^{\text {st }}$ year and $b \%$ is given for $2^{\text {nd }}$ year.
Net rate of CI for $2 \mathrm{yrs}=(\mathrm{a}+\mathrm{b}+\mathrm{ab} / 100)$ \% (discussed in percentage study notes)
Note: The net CI rate will be the same if $b \%$ is given for $1^{\text {st }}$ year and $a \%$ is given for $2^{\text {nd }}$ year.
Example: If principal is 1000 Rs and $\mathrm{r}\left(1^{\text {st }} \mathrm{yr}\right)=4 \%$ and $\mathrm{r}\left(2^{\text {nd }} \mathrm{yr}\right)=6 \%$. Calculate the CI after 2yrs.

## Solution:

Net CI rate $=4+6+(4 \times 6) / 100$
= 10.24\%
Now CI $=1000 \times 10.24 \%=$ Rs. 102.4
Concept 6: When difference between CI and SI is given.
We know, net CI for $2 y r s=2 r+\left(r^{2} / 100\right) \%$,
net SI for $2 \mathrm{yrs}=2 \mathrm{r} \%$
So, difference $=\left(r^{2} / 100\right) \%$
Example: If the difference between CI and SI is Rs. 10 and the principal is Rs.1000. Calculate the rate \% per annum.
Solution: difference $=10$ Rs.
So difference\% $=(10 / 1000) \times 100=1 \%$
We know that, if rate of interest is $10 \%$
then, net CI rate ( 2 yrs ) $=21 \%$
net SI rate ( 2 yrs ) $=20 \%$
difference = 1\%
Definitely we can say $\mathrm{r} \%$ per annum is $10 \%$.

Example: Calculate the difference between CI and SI for 3 yrs if Principal $=8000$ and $r=6 \%$ p.a.
Solution: Net rate CI(3yrs) $=19.1016 \%$
Net rate SI (3yrs) = 18\%
Difference $=1.1016 \%$
So, difference $=1.1016 \%$ of $8000=88.128$
Example: If difference between CI and SI for 2 years is Rs. 64 and $r=8 \%$ p.a. Calculate the Principal and Amount?
Solution: If $r=8 \%$ p.a.
then, net rate CI (2yrs) - net rate SI (2yrs)
$=16.64 \%-16 \%=0.64 \%$
Given, difference is Rs. 64
So, $0.64 \%=64$
$100 \%=10000$
Hence, Principal is 10000 Rs.
Amount $=$ principal $\times(116.64 \%)=10000 \times 116.64 \%=$ Rs. 11664

## Concept 7 : Calculation of Instalment

For 2 yrs : If $\mathrm{r} \%$ is given, convert it into fraction (a/b)
then, Instalment $\times \frac{b}{a+b} \times \frac{b+a+b}{a+b}=$ Principal
Example: A man borrowed Rs.8,400 at 10\% p.a. CI. He pays equal annual repayment of X rs and clear off his debts in 2 yrs . What is the value of X ?
Solution: Given $r=10 \%=(1 / 10)$
Instalment $\times \frac{10}{11} \times \frac{10+11}{11}=8400$
$\mathrm{X} \times \frac{10}{11} \times \frac{21}{11}=8400$
$\mathrm{X}=4840 \mathrm{Rs}$.
For 3 yrs: If r\% p.a. is given, convert it into fraction(a/b)
Instalment $\times \frac{b}{a+b}\left[\frac{b^{2}+(a+b)^{2}+b(a+b)}{(a+b)^{2}}\right]=$ Principal
Example: A man borrowed Rs. 1820 at $20 \%$ p.a. CI. He pays equal annual repayment of X rs and clear off his debts in 3 yrs . What is the value of $X$ ?

Solution: Given $r=20 \%=(1 / 5)$
Instalment $\times \frac{5}{5+1}\left[\frac{5^{2}+(1+5)^{2}+5(1+5)}{(1+5)^{2}}\right]=1820$
$X \times \frac{5}{6} \times \frac{5^{2}+6^{2}+5 \times 6}{6^{2}}=8400$
$X \times \frac{5}{6} \times \frac{91}{36}=8400$
$\mathrm{X}=864$

## Formulas:

Amount $=\mathrm{P}\left(\mathbf{1}+\frac{r}{100}\right)^{\mathrm{n}}$
Difference between Cl and SI for $2 \mathrm{yrs}=\mathrm{P} \times\left(\frac{r}{100}\right)^{2}$
Difference between CI and SI for $3 \mathrm{yrs}=\mathrm{P} \times\left(\frac{r}{100}\right)^{2} \times\left(\frac{\mathbf{3 0 0}+r}{100}\right)$
Where $\mathbf{P}=$ Principal, $r=$ rate of interest and $\mathbf{n}=$ no. of $\mathbf{y r s}$

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