# 9.SIMPLE INTEREST & COMPOUND INTEREST

## Simple Interest - Important Formulas

- *Principal:*

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

- *Interest:*

Extra money paid for using other's money is called *interest*.

- Simple Interest (S.I.):

If the interest on a sum borrowed for certain period is reckoned uniformly, then it is called *simple interest*.

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

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

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

## Compound Interest - Important Formulas

- Let Principal = P, Rate = R% per annum, Time = *n* years.
- *When interest is compound Annually:*

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

- *When interest is compounded Half-yearly:*

$$\text{Amount} = P\left[1 + \frac{(R/2)}{100}\right]^{2n}$$

- *When interest is compounded Quarterly:*

$$\text{Amount} = P\left[1 + (R/4)\right]^{4n}$$



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$$\frac{}{100}$$

- *When interest is compounded Annually but time is in fraction, say* $3\frac{2}{5}$ *years.*

$$\text{Amount} = P\left(1+\frac{R}{100}\right)3x\left(1+\frac{\frac{2}{5}R}{100}\right)$$

- *When Rates are different for different years*, say $R_1\%$, $R_2\%$, $R_3\%$ for $1^{st}$, $2^{nd}$ and $3^{rd}$ year respectively.

$$\text{Then, Amount} = P\left(1+\frac{R_1}{100}\right)\left(1+\frac{R_2}{100}\right)\left(1+\frac{R_3}{100}\right).$$

- *Present worth of Rs. x due n years hence is given by:*

$$\text{Present Worth} = \frac{x}{\left(1+\frac{R}{100}\right)}.$$

**(1) The basic concept of CI and SI**

Let's say you have Rs. 30000 and you keep this money in three different banks for 2 years(Rs. 10000 each). The three banks have different policy :

a) Bank A keeps your money at simple interest and offers you 5% interest

b) Bank B keeps your money at compound interest and offers you 5% interest. The interest is compounded annually.

Bank C keeps your money at compound interest and offers you 5% interest. The interest is compounded half-yearly.

After 2 years, which bank will give you most interest?

Let us calculate

**Case (A)**

Simple interest is calculated simply as (P*R*T)/100

Here P= 10000, r = 5% and T = 2 years

T = 2 years. Let's divide this period in two equal intervals of 1 year each

Hence SI received for the period 0 to 1 = 10000*5*1/100 = Rs. 500

SI received for the period 1 to 2 = 10000*5*1/100 = Rs. 500

So after 2 years, you will get Rs. 10000 + 500 + 500 = Rs. 11000

**Note :** Simple Interest is proportional. The interest received is same each year. So in the above example where SI was Rs. 500 for 1 years, that will mean the SI for 3 years is Rs. 1500, the SI for 5 years is Rs. 2500 and so on.

**Case (B)**

Compounded annually means whatever interest you will earn on first year, that interest will be added to the principal to calculate the interest for 2nd year. Let us see how



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We know the CI formula is, Amount = P(1 + r/100)^t  (where Amount = P + CI)
CI received for the period 0 to 1 = Amount - Principal = 10000(1 + 5/100)^1 - 10000= Rs. 500
Now the amount received after 1 year will act as the Principal for calculating the Amount for next year
For calculating the amount for second year, you won't take P as 10000, but as Rs. 10500. So unlike SI where the interest was same each year, in CI the interest increases every year (because the principal increases every year)
CI received for the period 1 to 2 = Amount - Principal = 10500(1 + 5/100)^1 - 10500 = Rs. 525
Total interest received after two years = Rs. 500 + Rs. 525 = Rs. 1025
Total amount received after two years = Rs. 11025
**Note :** In Case (b), to calculate the amount received after 2 years, I had divided the calculation into 2 intervals. It was done just for the sake of explanation. You can calculate the amount received after 2 years directly by 10000(1 + 5/100)^2

**Case (C)**
Just like case (b), where Principal was getting updated every year, in case (c) we will update the Principal every 6 months (half-year)
Since I have given the explanation in case (b), so in this case I will directly apply the formula
Amount received after 2 years = 10000(1 + 2.5/100)^4 = Rs. 11038 approx.

So sum it up
Case A - amount received after two years= Rs. 11000
Case B - amount received after two years= Rs. 11025
Case C - amount received after two years= Rs. 11038

**Case C is giving the maximum return and rightly so because in Case (C) principal is increasing every 6 months.**

**Important formulas for Compund Interest -**

1. Let Principal = P, Rate = R% per annum, Time = $n$ years.
2. **When interest is compound Annually:**

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

3. **When interest is compounded Half-yearly:**

$$\text{Amount} = P\left[1 + \frac{(R/2)}{100}\right]^{2n}$$

4. **When interest is compounded Quarterly:**

$$\text{Amount} = P\left[1 + \frac{(R/4)}{100}\right]^{4n}$$

5. **When interest is compounded Annually but time is in fraction, say $3\frac{2}{5}$ years.**

$$\text{Amount} = P\left(1 + \frac{R}{100}\right)^3 \times \left(1 + \frac{\frac{2}{5}R}{100}\right)$$

**(2) A sum of money becomes x times in T years. In how many years will it become y times?**

The approach to solve such questions is different for SI and CI

**For SI :** Formula = [(y - 1)/(x - 1)] * T
**Q. 1)** A sum of money becomes three times in 5 years. In how many years will the same sum become 6 times at the same rate of simple interest?
Solution : [(6 - 1)/(3 - 1)] * 5 = 5/2 * 5 = 12.5 years
**Answer : 12.5 years**

**For CI :** Formula = (logy/logx) * T
Now dont worry, I wont be asking you to study logarithms :)
But just remember one property of logs and that is enough to solve the questions
$\log(x^y) = y.\log(x)$
Hence $\log(8) = \log(2^3) = 3.\log(2)$
**Q. 2)** A sum of money kept at compound interest becomes three times in 3 years. In how many years will it be 9 times itself?
Solution : (log9/log3) * 3 ... (1)
$\log 9 = \log(3^2) = 2.\log(3)$
Put this value in (1)
= 2.log(3)/log(3) * 3
= 2 * 3 = 6 years
**Answer : 6 years**

**(3) <u>Interest for a number of days</u>**

**Q. 3)** Find the simple interest on Rs 306. 25 from March 3rd to July 27th at $3\frac{3}{4}\%$ per annum.

Here P = 306.25
R = 15/4 %
T = Number of days/365
Number of days = Count the days from March 3rd to July 27th but **omit the first day, i.e., 3rd March**
= 28 days(March) + 30 days(April) + 31 days(May) + 30 days(June) + 27 days(July)
= 146 days
We know SI = (P * r * t)/100

**Sol.** Interest = Rs $306\frac{1}{4} \times \frac{146}{365} \times \frac{15}{4} \times \frac{1}{100}$

**Answer : Rs. 4.59**

**(4) Annual Instalments**

This is the most dreaded topic of CI-SI. Before giving you the direct formula, I would like to tell you what actually is the concept of annual instalments(if you only want the formula and not the explanation, you can skip this part. But I would like you to read it)

Suppose you want to purchase an iPhone and its price is Rs. 100000 but you dont have Rs. 1 lakh as of now. What would you do? You have two options - either you can sell your kidney (which most the iphone buyers do :D), or you can go for instalments. But if you want to buy the iPhone through this instalment route, the seller will incur a loss. How? Had you paid Rs. 1 lakh in one go, the seller would have kept that money in his savings account and earned some interest on it. But you will pay this Rs. 1 lakh in instalments and that means the seller will get his Rs. 1 lakh after several years. So the seller is incurring a loss. The seller will compensate for this loss and will charge interest from you.

Let the annual instalment be Rs. x. and you pay it for 4 years.

After 1 year you will pay Rs. x and the seller will immediately put this money in his savings account (or somewhere else) to earn interest. He will earn interest on this Rs. x at the rate of r% for 3 years (because the total duration is 4 years and 1 year has already passed)

Hence the amount which the seller will get from this Rs. x instalment = x(1 + r/100)^3

After 2nd year, you will again pay Rs. x and the seller will earn interest on this Rs. x for 2 years.

The amount which the seller will get from this Rs. x instalment = x(1 + r/100)^2

After 3rd year, you will again pay Rs. x and the seller will earn interest on this Rs. x for 1 year.

The amount which the seller will get from this Rs. x instalment = x(1 + r/100)^1

After 4th year, you will pay Rs. x and your debt would be paid in full (no interest on this Rs. x)

The amount which the seller will get from this Rs. x instalment = x

Now let's add all the above four amounts to get the total amount the seller would get from all the instalments =

x(1 + r/100)^3 + x(1 + r/100)^2 + x(1 + r/100)^1 + x ... (1)

Now, had you paid Rs. 1 lakh in one go (without going for the instalment route), then the amount received by the seller after 4 years would have been = 100000(1+r/100)^4 ... (2)

Now (1) should be equal to (2) because only then the two routes (instalment route and direct payment route) will give the same return and seller would have no problem in giving you the iPhone in instalments.

**100000(1+r/100)^4 = x(1 + r/100)^3 + x(1 + r/100)^2 + x(1 + r/100)^1 + x**
**[Remember the above equation for solving questions of compound interest]**

**P + P*r*4/100 = (x + x*r*3/100) + (x + x*r*2/100) + (x + x*r*1/100) + x**
**[Remember the above equation for solving questions of simple interest]**

**Although for Simple Interest, we have a direct formula-**

The annual instalment value is given by-

$$\frac{100A}{100t + \frac{rt(t-1)}{2}}.$$

Now coming to the questions. There are two types of questions and they are bit confusing. In one type, the Amount is given and in another type, Principal is given

**Type 1(Amount is given):**

**Q. 4) What annual installment will discharge a debt of Rs.6450 due in 4 years at 5% simple interest?**
When the language the question is like "what annual payment will discharge a debt of ...", it means the Amount is given in the question.
In this question, the Amount(A) is given, i.e., Rs. 6450. So we can apply the formula directly
Here A = 6450, r = 5%, t = 4 years
Solution : 100*6450/[100*4 + 5*4*3/4]
**Answer : 1500**

**Type 2 (Principal is given) :**

**Q. 5) A sum of Rs. 6450 is borrowed at 5% simple interest and is paid back in 4 equal annual installments. What is amount of each installment?**
Here the sum is given. Sum means Principal.
But our formula requires Amount(A)
So we will calculate Amount from this Principal
A = P + SI = 6450 + 6450*5*4/100 = Rs. 7740
Now put the values in the formula
A = 7740, r = 5%, t = 4
Annual instalment = 100*7740/(100*4 + 5*4*3/2)
**Answer : Rs. 1800**

**Q. 6)** A sum of money is paid back in two annual instalments of ₹17,640 each, allowing 5% compound interest compounded annually. The sum borrowed was
(A) ₹32,400 (B) ₹32,800
(C) ₹32,000 (D) ₹32,200

**"Sum borrowed" means Principal.**
**This question is of Compound Interest and hence we cant apply the direct formula. We will solve this question with the help of the equation we derived earlier.**

**P(1+r/100)^2 = x(1+r/100) + x**
P(1 + 5/100)^2 = 17640(1 + 5/100) + 17640
Solve for P, you will get P = Rs.32800
**Answer : (B)**

**Q. 7) What annual instalment will discharge a loan of Rs. 66000, due in 3 years at 10% Compound Interest?**
**Solution :** Here again the question is of "Compound Interest" and hence we will solve it by

equation :
Let each annual instalment be of Rs. x. Note that in this question, amount is given
Amount = x(1 + 10/100)^2 + x(1 + 10/100)^1 + x
66000 = x (1.21 + 1.1 + 1)
So x = Rs. 19939.58

**Q. 8) What annual instalment will discharge a loan of Rs. 66000, due in 3 years at 10% Simple Interest?**
I have just converted Q.7 into Simple Interest
Now we can either solve it by direct formula, or by equation
**By Equation method :**
66000 = (x + x*10*2/100) + (x + x*10*1/100) + x
66000 = x(3 + 0.2 + 0.1)
x = Rs. 20000
**By Direct formula method :**
A = 66000, t = 3, r = 10%
x = 100A/[100t + t(t-1)r/2]
x = 100*66000/[100*3 + 3*2*10/2]
x = 6600000/(300 + 30)
x = Rs. 20000

**Q. 1) If a sum of money becomes 3 times itself in 20 years at simple interest. What is the rate of interest?**
In such questions apply the direct formula-
Rate of interest = [100*(Multiple factor - 1)]/T
So R = 100*(3 - 1)/20
**Answer : 10%**
**Note :** With this formula you can find Rate if Time is given and Time if rate is given.

**Q. 2)**
Divide Rs. 2379 into 3 parts so that their amounts after 2, 3 and 4 years respectively may be equal, the rate of interest being 5% per annum at simple interest. The first part is :

A. Rs. 759
B. Rs. 792
C. Rs. 818
D. Rs. 828

In such questions, just write this line :
**1st part : 2nd part : 3rd part = 1/(100+T1 * r) : 1/(100+T2 * r) : 1/(100+T3 * r)**
= 1/(100+2 * 5) : 1/(100+3 * 5) : 1/(100+4*5)
= 1/110 : 1/115 : 1/120

= 23*24 : 22*24 : 23*22
Hence 1st part = (23*24)/ (23*24 + 22*24 + 23*22) * 2379
**Answer : 828**
**Note :** Surprisingly, such questions when asked mostly have this same data, i.e., R=5% and T1, T2, T3 = 2, 3, 4 years, respectively. Only the Principal is changed. So it would be wise if you can just mug this line :
**1st part : 2nd part : 3rd part = 23*24 : 22*24 : 23*22**
**Based on the above line, you would be able to solve such questions in a jiffy.**
**<u>But note that it will only work if the question is on Simple Interest</u>. Like the below question appeared in SSC CGL Tier 2-**

**Q. 4** A sum of ₹7,930 is divided into 3 parts and given on loan at 5% simple interest to A, B and C for 2,3 and 4 years respectively. If the amounts of all three are equal after their respective periods of loan, then the A received a loan of
(A) ₹2,750 (B) ₹2,800 (C) ₹2,760 (D) ₹3,050

Here the data is same**.** i.e., R=5% and T1, T2, T3 = 2, 3, 4 years, respectively. So we will write directly -
**1st part : 2nd part : 3rd part = 23*24 : 22*24 : 23*22**
A received **=** (23*24)/ (23*24 + 22*24 + 23*22) * 7930
**Answer : Rs. 2760**

**Q. 5)** If a certain sum of money P lent out for a certain time T amounts to $P_1$ at $R_1$% per annum and to $P_2$ at $R_2$% per annum, then

$$T = \frac{P_1 - P_2}{P_2R_1 - P_1R_2} \times 100 \text{ years}$$

**The above formula is for calculating the Time, if the question asks the rate, then just interchange the rate and time. Hence the formula will become**

**$R = (P_1 - P_2)*100/P_2T_1 - P_1T_2$**

: A sum of money at simple interest amounts to Rs 600 in 4 years and Rs 650 in 6 years. Find the rate of interest per annum.

Apply the formula:
R = (650-600)*100/600*6 - 650*4
R = 5%

**Alternative Method :**
You can solve such questions quickly without mugging the above formula. How?
The sum amounts to Rs. 600 in 4 years and Rs. 650 in 6 years. This means the simple interest is Rs. 50 for 2 years (because the amount increased from Rs. 600 to Rs. 650 in 2 years)

So the SI for 4 years is Rs. 100 (we have seen earlier than SI is proportional. So if SI = 100 for 2 years, then SI = 150 for 3 years, SI = 250 for 5 years and so on)

Now SI = Rs. 100; P = 600-100 = Rs. 500; t = 4 years
R = 100*SI/(P*t) = 10000/2000
**Answer: 5%**

**For CI, the formula is different**

If a certain sum of money at compound interest amounts to Rs.x in $t_1$ years and Rs.y in $t_2$ years, then the rate of interest per annum can be given by

$$R = \left[\left(\frac{y}{x}\right)^{1/(t_2-t_1)} - 1\right] \times 100\%$$

**Difference between CI and SI**

This topic is very important from examination point of view. Note the following things-
If t=1 year, then SI = CI
If t=2 years then difference between CI and SI can be given by two formulas-

$$= P\left(\frac{R}{100}\right)^2$$

$$= \frac{R \times SI}{2 \times 100}$$

If t=3 years then difference between CI and SI can be given by two formulas-

$$= P\left(\frac{R}{100}\right)^2\left(\frac{R}{100} + 3\right)$$

$$= \frac{SI}{3}\left[\left(\frac{R}{100}\right)^2 + 3\left(\frac{R}{100}\right)\right]$$

**In all the above formulas we have assumed that the interest is compounded annually**

**Let us solve some CGL questions**

**Q. 6** If a sum of money compounded annually becomes 1·44 times of itself in 2 years, then the rate of interest per annum is

(A) 25% (B) 22%
(C) 21% (D) 20%

A = P(1+r/100)^t
Given, A=1.44P t = 2 years
1.44P = P(1 + r/100)^2
r = 20%
**Answer : (D)**

**Q. 7** What sum will give ₹ 244 as the difference between simple interest and compound interest at 10% in $1\frac{1}{2}$ years compounded half yearly ?

(A) ₹ 40,000 (B) ₹ 36,000
(C) ₹ 32,000 (D) ₹ 28,000

Here the interest is compounded half yearly, so the formulas we mugged earlier are of no use here. We will have to solve this question manually
SI = P*10*1.5/100 = 0.15P
CI = P(1 + 5/100)^3 - P = P(1.05^3 - 1)
Given CI - SI = 244
P(1.05^3 - 1) - 0.15P = 244
P = Rs. 32000
**Answer : (C)**

**Q. 8** If the compound interest on a sum for 2 years at $12\frac{1}{2}$% p.a. is ₹ 510, the simple interest on the same sum at the same rate for the same period of time is

(A) ₹ 400 (B) ₹ 450
(C) ₹ 460 (D) ₹ 480

Time = 2 years
Hence apply the formula: Difference(D) = R*SI/200
CI - SI = R*SI/200
CI - SI = (12.5/200)*SI
510 = 1.0625*SI [Since CI = Rs. 510]
SI = Rs. 480
**Answer : (D)**

**Q. 9** The compound interest on ₹ 1,800 at 10% per annum for a certain period of time is ₹ 378. Find the time in years.

(A) 2·5 years (B) 2·0 years
(C) 2·8 years (D) 3·0 years

CI for 1st year = 10% of 1800 = Rs. 180
CI for 2nd years = 180 + 10% of 180 = Rs. 198
Total = 180+198 = Rs. 378
Hence time = 2 years
Or you can apply the formula
A = P(1+r/100)^t
**Answer : (B)**

**Q. 10** The difference between the interests received from two different banks on ₹ 500 for two years is ₹ 2.50. The difference between their rates is

(A) 1 % (B) .5 %
(C) 2.5 % (D) .25 %

2.5 = P*R*2/100 - P*r*2/100
2.5 = 10R - 10r
R - r = 0.25
**Answer : (D)**

**Q. 11** The compound interest on a certain sum of money for 2 years at 5% is ₹ 328, then the sum is

(A) ₹ 3000 (B) ₹ 3600
(C) ₹ 3200 (D) ₹ 3400

CI for 1st year = 5% of P = 0.05P
CI for 2nd year = 5% of P + 5% of (5% of P) = 0.05P + 0.0025P = 0.0525P
Total CI = 0.05P + 0.0525P = 0.1025P
Given, 0.1025P = 328
P = Rs. 3200
**Answer : (C)**
**Note : You can solve this question by the formula A = P(1+r/100)^t as well**

**Q. 12**

On a certain principal the compound interest compounded annually for the second year at 10% per annum is ₹ 132. The principal is

(A) ₹ 1000 (B) ₹ 1320

(C) ₹ 1250 (D) ₹ 1200

Note that in this question the CI for 2 years in not given, but the CI for the 2nd year is given.
CI for 2nd year = 10% of P + 10% of (10% of P) = 0.1P + 0.01P = 0.11P
Given, 0.11P = 132
P = Rs. 1200
**Answer : (D)**

**Q. 13**

The principal which gives ₹ 1 interest per day at a rate of 5% simple interest per annum is

(A) ₹ 7300 (B) ₹ 3650

(C) ₹ 5000 (D) ₹ 36500

Interest = Re. 1 per day = Rs. 365 for 1 year
SI = P*r*t/100
t=1, r=5%, SI = Rs. 365
So, P = 365*100/5 = Rs. 7300
**Answer : (A)**

**Q. 14**

The difference between compound and simple rates of interest on Rs. 10000 for 3 years at 5% p.a. is

(a) Rs. 76.50 (b) Rs. 76 (c) Rs. 76.25 (d) Rs. 76.75

We know
Difference = P(r/100)^2(r/100 + 3)
P = Rs. 10000, r = 5%, t = 3 years
Hence D = Rs. 76.25
**Answer : (C)**

**Q. 15**

An amount is invested in a bank at compound rate of interest, after first and third year is Rs. 1200 and Rs. 1587 respectively. What is the rate of interest?

(a) 12% (b) 15% (c) 10% (d) 3.9%

We know, R = [(y/x)^(1/T2 - T1) - 1]*100
= [(1587/1200)^1/(3 - 1) - 1]*100
= [(1587/1200)^1/2 - 1]*100
= 3/20 * 100
= 15%
**Answer : (B)**

Simple Interest examples:

**Example 1:** The simple interest obtained in 5 years on a principal of Rs. 40,000/- is 1/5 of the principle. Find the rate of interest of simple interest p.c.p.a.
**Answer :**40,000 x 1 / 5 = 8000
SI = PRT / 100 =
R = 40,000 x 5 / 100 x 8000 = 4 %

**Example 2:**
Amit give Rs. 6000 to Bijoy for 2 years and Rs. 2000 to Sabir for 5 years on simple interest at same rate of interest, and then he received Rs. 2200 as a interest from of them. Find the rate of interest per annum.
**Answer :** We know formula SI = P x R x T / 100
So, R% = ( 6000 x R x 2 / 100 ) + ( 2000 x R x 5 / 100 ) = 2200
R% = 120R + 100R = 2200
R = 2200 / 220 = 10%

**Example 3:**
At what rate percent annul will a sum of money double in a 4 years.
**Answer :**
Let Principle is = P.Then S.I = P and Time = 4 years.
S.I. = ( PRT/100 ).
So, R = ( 100X P / P X T ) %.
R = 25%

**Example 4:**
What is the rate of p.c.p.a ? If the simple interest accrued on amount of Rs.25500 at the end of 3 years is 9180.
**Answer :**
we know the formula is S.I = PRT / 100
So, S.I = 9180 , P = 25500 , T = 3 years , R = ?
9180 = 25500 x R x 3 / 100
R = 9180 / 765 = 12 %
So rate of p.c.p.a = 12 %

**Example 5:**
A sum of money is in double in 12 years At what rate percent per annul.



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**Answer :**
Let Principle = P. Then S.I = P and T is given 12 years.
Rate = ( 100 X P / P X 12 ) = 8.33%
So R = 8.33 %

**Example 6:**
If the Simple interest accrued in 8 years on a principal of Rs.40,000/- is 8000 of the principal. What is the rate of simple interest p.c.p.a?
**Answer :**
SI = PRT / 100
Let the rate of simple interest is x
So, x = 100 x 8000 / 40000 x 8
x = 2.5
So the rate of simple interest is 2.5.

**Example 7:** The simple interest deposited on an amount of Rs 26400 at the end of 3 years is Rs. 9504. What would be the rate of p.c.p.a ?
**Answer:** We know the formula S.I = PRT / 100
9504 = 26400 x r x 3 / 100
r = 9504 / 264 x 3 = 9504 / 792 = 12%

**Example 8:**
Suresh take a sum of money at simple interest amounts to Rs.985 in 2 years and to Rs. 885 in 3 years , find The sum of money suresh was taken.
**Answer :**
**Step 1:** Simple interest in 1 year is = Rs.( 985 – 885 ) = 100.
**Step 2**: Simple Interest in 2 years = Rs.100 X 2 = 200.
**Step 3:** So,Principal = ( 985 – 200 ) = 785.

**Example 9:**
Samar take a sum from Anup at simple interest at 25x / 2 per annul and amounts to Rs, 3202.50 after 6 years. Find the Sum or Principal taken by Samar from Anup .
**Answer :**
First We consider sum is x and Rate percent is 25x / 2 and Time is 6 years, So
**Step 1:** Then S.I. = P X R X T / 100 = 3x / 4.
**Step 2:** Amount = Sum + Simple Interest = x + 3x / 4 = 7x / 4.
**Step 3:** 7x / 4 = 3202.50 and x = 3202.50 X 4 / 7 = 1830.
Samar taken sum from Anup is 1830.

**Example 10:**
What is the amount of Rs.16000 at 5% per annul compound interest in 3 years ?
**Answer :**
Time = 3
rate = 5%

16000 x ( 105 / 100 ) = 16000 x 1157625 / 1000000
= 18522
So the amount is 18522.

**Example 11:**
John borrowed some money at the rate of 4% p.a for the First 3 years. at rate of 7% p.a. for the next 4 years. If he pays a total interest of Rs. 12,600 at the end of seven years, how much money did he borrow ?
**Answer :**
Let sum borrowed x then P = x
( P X R X T / 100 )
( x X 4 X 3 / 100) + ( x X 7 X 4 / 100) = 12600
( 3x / 25 + 7x / 25 ) = 12600
10x / 25 = 12600
x = 12600 x 25 / 10
x = 31500
So, sum he borrowed = Rs. 31500.

- **Find Simple interest using formula**

  **Formula : S.I = (P X R X T / 100)**

**Example 1:** What would be the simple interest got on an amount of Rs. 18,600 in 8 months at the rate of 22 / 2% p.a ?
**Answer :** 8 months = 8 / 12 = 2 / 3
SI = 18600 x 2 x 22 x 1 / 3 x 2 x 100 = Rs.1364

**Example 2:** What would be the simple interest on Rs. 20 for 5 month at the rate of 6 paise per rupee per month
**Answer : Simple interest =** 20 x 6 x 6 / 100 = Rs. 6.

**Example 3:**
Find the Simple Interest on Rs. 75000 at 4% per annul for 4 years.
**Answer:**
we know Principal
P = Rs. 75000
R% = 4 per annul
T year = 4 years.
we just put the value into formula.
P = Rs. 75000, R = 4% p.a ( per annul ) T = 4 years.
S.I = ( P X R X T / 100 ) = 75000 X 4 X 4 /100 = 12000.
So the S.I is 12000.

**Example 4:**
On amount of 7530 at the rate of 18 p.c.p.a for 6 years What will be the simple interest ?
**Answer :**



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S.I = P R T / 100
S.I = 7530 x 18 x 6 / 100
S.I = 8132.40
So, the simple interest is 8132.40.

**Example 5:** Find the time required Rs 10000 amount to Rs. 12000 at the rate of 4% per annum at S.I ?
**Answer :** we know SI = PRT / 100
= 1000 = 10000 X 4 X T / 100
t = 10000 X 4 / 100 X 2000
t = 5 years.

**Example 6:**
What will be the Ration of the Simple interest earned by certain amount at the same rate of interest for 5 years and 7 years ?
**Answer :**
**step 1:** Let Principal P and Rate of interest be R %.
So Required interest of 5 years is S.I = P R T / 100 = P x R x 5 / 100 = 5 PR / 100.
Required interest of 7 years is S.I = P R T / 100 = P x R x 7 / 100 = 7 PR / 100.
**Step 2:** Required ration is = 5 PR / 7 PR = 5 / 7 = 5 : 7.
So, Required Ration is 5 : 7.

**Example 7:** What would be the simple interest acquired by certain amount at the same rate of interest for 4 years and also that for 8 years ?
**Answer :** Let principle P and rate of interest = R%. Time = 4 years and 8 years.
we know the formula : Simple interest = PRT / 100.
[ PxRx4 / 100 : PxRx8 / 100 ] = 4PR / 8PR = 4 / 8 = 1 : 2.

**Example 8:** Find the Simple Interest on Rs. 40000 at 25 / 4 % per annul for the period from 4th January, 2013 to 18th march, 2013.
**Answer:**
**Step 1:** First we calculate the period of time taken that is =
January = (31 – 4) = 27 days,
February = 28 days,
March = 18 day.
Add all together ( 27 + 28 + 18 ) = 73 / 365 year = 1 / 5 years.
**Step 2:** we know Principal P = 40000, and R = 25 / 4 % p.a.
**Step 3:** S.I = Rs. ( 40000 X 25 X 1 X 1 / 4 X 100 X 5 ) = Rs. 500
So, the S.I is 500.

**Example 9:** What would be the simple interest earned by certain amount, at the same rate of interest for 4 years
and that for 8 years ?
**Answer:**
Let the principal be P
Rate of interest be R%

Time is 4 years and 8 years
So, Required ratio is = ( P x R x 4 /100 ) / ( P x R x 8 /100 ) = 4 / 8 = 1 / 2 = 1 : 2.

**Example 10:** What would be the simple interest on Rs. 85,000 at 15% per annum for 8 month
**Answer:** S.I = 85,000 x 2 x 15 / 3 x 100 = Rs. 8500.

**Example 11:** What would be the simple interest earned on an amount of Rs. 18,600 in 8 months at the rate of 18 / 2% per annul ?
**Answer:** 18,600 x 2 x 1 x 18 / 3 x 100 x 2 = 1116.

**Example 12:** What would be simple interest on Rs. 1860 from 2nd April to 21 June 2014 at the rate of 20 / 2% ?
**Answer:** 2nd April to 21 June 2014 = ( 28 + 31 + 21 ) = 80 days,
1860 x 20 x 1 x 20 / 2 x 100 x 3 = 1240.

**Example 13:** If Rs. 75 amounts to Rs. 90 in 2 years, What would be Rs. 120 amount to in 6 years at the same time rate percent p.a ?
**Answer:** P = 75, So SI = ( 90 – 75 ) = Rs. 15, and time = 2 years
So, rate = 100 x 15 / 75 = 20%.
P = Rs. 120, R = 20% time = 6 years,
So, SI = 120 x 20 x 6 / 100 = Rs. 144.

## Shortcut for finding compound interest

In some cases evaluation of C.I using formula will be time consuming. Here is an alternate method for calculating compound interest.

Let Principle = P, Compound interest % = x % per annum , Time period=T

Total interest percentage for the first year=x,

Total interest percentage for the second year=x + x% of x= x+ (x*x/100)

Then effective percentage of interest =2x + x*x/100

Then C.I=(2 x + x*x/100) % of P= P*[(2x + x*x/100)/100]

Total interest percentage for the first year=x,

Total interest percentage for the second year=x + x% of x= x+ (x*x/100)

Total interest percentage for the third year= x + x % of ( x + x+ x*x/100) =x+ x*( x + x+ x*x/100)/100)

Then effective percentage of interest= x+ x+ (x*x/100) + x+ x*( x + x+ x*x/100)/100)= 3x+ (x*x/100) +x*( 2x + x*x/100)/100)



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You may be finding formulas lengthy, but you will find this method simpler after practicing some problems.Especially if T=2, then this method will be much faster than conventional method using the commonly used formula.

Now let us solve two problems using above method.

Example 1 : What is the compound interest paid on a sum of Rs.3000 for the period of 2 years at 10% per annum.

Solution= Interest % for 1st year= 10

Interest % for 2nd year= 10+ 10% of 10= 10+ 10 *10/100=11

Total % of interest= 10 + 11=21

Total interest = 21 % 3000= 3000 * (21/100)= 630

Example 2:What is the compound interest paid on a sum of Rs.3000 for the period of 3 years at 10% per annum.

Solution= Interest % for 1st year= 10

Interest % for 2nd year= 10+ 10% of 10= 10+ 10 *10/100=11

Interest % for 3rd year= 10+ 10%(10+11)=10+ 2.1=12.1

Total % of interest= 10 + 11+12.1=33.1

Total interest = 33.1 % 3000= 3000 * (33.1/100)= 993

# Shortcut Formulas for Compound Interest

**Rule 1: If rate of interest is R1% for first year, R2% for second year and R3% for third year, then**

$$A = P\left(1 + \frac{R_1}{100}\right)\left(1 + \frac{R_2}{100}\right)\left(1 + \frac{R_3}{100}\right)$$

Example

**Find the total amount after three years on Rs 1000 if the compound interest rate for first year is 4%, for second year is 5% and for third year is 10%**
**Sol:**

P = 1000
$R_1$ = 4%, $R_2$ = 5% and $R_3$ = 10%

$$A = P\left(1 + \frac{R_1}{100}\right)\left(1 + \frac{R_2}{100}\right)\left(1 + \frac{R_3}{100}\right)$$

$$A = 1000\left(1 + \frac{4}{100}\right)\left(1 + \frac{5}{100}\right)\left(1 + \frac{10}{100}\right)$$

$$A = 1000 \times \frac{26}{25} \times \frac{21}{20} \times \frac{11}{10}$$

(From the table given at the bottom of the page)

A = 1201.2

**Rule 2:**
If principle = P, Rate = R% and Time = T years then

1. **If the interest is compounded annually:**

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

2. **If the interest is compounded half yearly (two times in year):**

$$A = P\left(1 + \frac{R/2}{100}\right)^{2T}$$

3. **If the interest is compounded quarterly (four times in year):**

$$A = P\left(1 + \frac{R/4}{100}\right)^{4T}$$

Example



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**Find the total amount on 1000 after 2 years at the rate of 4% if**

1. **The interest is compounded annually**
2. **The interest is compounded half yearly**
3. **The interest is compounded quarterly.**

**Sol:**

Here P = 1000
R = 4%
T = 2 years
**If the interest is compounded annually**

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

$$A = 1000\left(1 + \frac{4}{100}\right)^{2}$$

$$A = 1000 \times \frac{676}{625}$$

(From the table given at the bottom of the page)

A = 1081.6
**If the interest is compounded half yearly**

$$A = P\left(1 + \frac{R/2}{100}\right)^{2T}$$

$$A = 1000\left(1 + \frac{4/2}{100}\right)^{4}$$

A = 1082.4
**If the interest is compounded quarterly**



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$$A = P\left(1 + \frac{R/4}{100}\right)^{4T}$$

$$A = 1000\left(1 + \frac{4/4}{100}\right)^{8}$$

A = 1082.9

**Rule 3: If difference between Simple Interest and Compound Interest is given.**

- If the difference between Simple Interest and Compound Interest on a certain sum of money for 2 years at R% rate is given then

$$\text{Sum} = \text{Difference}\left(\frac{100}{R}\right)^2$$

Example

**If the difference between simple interest and compound interest on a certain sum of money at 10% per annum for 2 years is Rs 2 then find the sum.**
**Sum:**

$$\text{Sum} = \text{Difference}\left(\frac{100}{R}\right)^2$$

$$\text{Sum} = 2\left(\frac{100}{10}\right)^2 = 200$$

- If the difference between Simple Interest and Compound Interest on a certain sum of money for 3 years at R% is given then

$$\text{Sum} = \frac{\text{Difference} \times 100^3}{R^2(300 + R)}$$

Example



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**If the difference between simple interest and compound interest on a certain sum of money at 10% per annum for 3 years is Rs 2 then find the sum.**
**Sol:**

$$\text{Sum} = \frac{\text{Difference} \times 100^3}{\text{R}^2(300 + \text{R})}$$

$$\text{Sum} = \frac{2 \times 100^3}{10^2(300 + 10)} = 64.5$$

**Rule 4: If sum A becomes B in $T_1$ years at compound interest, then after $T_2$ years**

$$\text{Sum} = \frac{\text{B}^{\frac{\text{T}_2}{\text{T}_1}}}{\text{A}^{\frac{\text{T}_2}{\text{T}_1}-1}}$$

Example

**Rs 1000 becomes 1100 after 4 years at certain compound interest rate. What will be the sum after 8 years?**
**Sum:**
Here A = 1000, B = 1100
$T_1 = 4$, $T_2 = 8$

$$\text{Sum} = \frac{1100^{\frac{8}{4}}}{1000^{\frac{8}{4}-1}} = \frac{1100 \times 1100}{1000} = 1210$$

Look up Table

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| | 4% | 5% | 10% | 20% |
|---|---|---|---|---|
| 1 Year $\left(1+\frac{R}{100}\right)$ | $\frac{26}{25}$ | $\frac{21}{20}$ | $\frac{11}{10}$ | $\frac{6}{5}$ |
| 2 Years $\left(1+\frac{R}{100}\right)^2$ | $\frac{676}{625}$ | $\frac{441}{400}$ | $\frac{121}{100}$ | $\frac{36}{25}$ |
| 3 Years $\left(1+\frac{R}{100}\right)^3$ | $\frac{17576}{15625}$ | $\frac{9261}{8000}$ | $\frac{1331}{1000}$ | $\frac{216}{125}$ |
| 4 Years $\left(1+\frac{R}{100}\right)^4$ | $\frac{456976}{390625}$ | $\frac{194481}{160000}$ | $\frac{14641}{10000}$ | $\frac{1296}{625}$ |

## Simple interest, compound interest practice questions

1.A man derives his income from an investment of Rs.2000 at a certain rate of interest and Rs.1600 at 2% higher. The whole interest in 3 years is Rs.960. Find the rate of interest.

Answer:8%

2.A man buys a house and pays Rs.8000 cash and Rs.9600 at 5 year credit at 4% per annum simple interest. Find the cash price of the house.

Answer: Rs.16000

3.The simple interest on a certain sum of money for 3 years at 4% is Rs.303.60. Find the compound interest on the same sum for the same period at the same rate.

Answer:315.90

4.If a certain sum given on simple intrest doubles in 20 years. In how many years will it be four times?

Answer:60 years

5.A sum of money placed at compound interest doubles itself in 4 years. In how many years will it amount to 8 times.

**Answer:12 years**