CA. Pranav Popat

→ A commerce graduate and first attempt Chartered Accountant, Pranav is one the youngest CA Faculties in India. He loves Public Speaking and motivating students. His unique approach of teaching helps commerce students to get rid of “MATHS PHOBIA”.

→ Currently, he teaches Mathematics, Statistics & Logical Reasoning (Foundation Level CA/CS) and Cost/Management Accounting (CA Inter). Students admire him for creating very interactive learning environment in the classroom which helps them to get more connected to the subject practically.

→ He worked with Wipro Limited for 2 years in the area of cost control and deal pricing. In his 3 years practical training, he earned exposure in the field of Auditing, Industrial Implementation and other Financial Services for various corporate as well as PSU clients.

→ His Motto in Life: When life puts you in trouble, don’t say WHY ME? Just say TRY ME!!!!

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Time value of money formula and tricks
### Simple Interest

<table>
<thead>
<tr>
<th>Formula for SI</th>
<th>[ S.I. = \frac{P \times r \times t}{100} ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula for Accumulated Amount under SI</td>
<td>[ A = P + S.I ] (amount is also called as Balance)</td>
</tr>
<tr>
<td>Using Calculator</td>
<td>Press ( P \times r \times t \div 100 )</td>
</tr>
</tbody>
</table>

#### Example 1: Find out SI
S.I on ₹ 3,500 for 3 years at 12% per annum is?

#### Example 2: Find out Rate of Interest
\( P = ₹ 12,000, A = ₹ 16,500, T = 2 \frac{1}{2} \) years. Rate percent per annum simple interest will be?

#### Example 3: Find out Time Period
\( P = ₹ 8,500, A = ₹ 10,200, R = 12 \frac{1}{2} \% \) SI, t will be?
## Compound Interest

### Conversion Periods

<table>
<thead>
<tr>
<th>Conversion Period</th>
<th>No. of Conversion Periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yearly</td>
<td>1</td>
</tr>
<tr>
<td>Half-yearly</td>
<td>2</td>
</tr>
<tr>
<td>Quarterly</td>
<td>4</td>
</tr>
<tr>
<td>Monthly</td>
<td>12</td>
</tr>
<tr>
<td>Daily</td>
<td>365</td>
</tr>
</tbody>
</table>

### Formulas in C.I.

Accumulated Amount under CI:

\[ A = P(1+i)^n \]

Where, \( P \) = Principal, \( i \) = adjusted interest rate, \( n \) = no. of periods

Adjusted interest rate \( i \):

- Annual interest rate
- No. of conversion periods

Example: if rate is 6% p.a. and compounding is half yearly, \( i = \frac{6}{2} = 3\% \)

No. of periods:

- Time in year \( \times \) no. of conversion periods.
- Ex: if time is 2 years and compounding is quarterly, \( n = 2 \times 4 = 8 \)

Calculator Trick for Amount of CI:

Example: \( P = 1000 \), \( i = 10\% \), \( n = 3 \) then

Calculator Steps to obtain \( A \):

- Write \( P \) i.e \( 1000 \)
- then press \( + \) 10% \( + \) 10% \( + \) 10% \( \) (three times because \( n = 3 \)),

Use of formula using Calculator:

Example: \( P = 1000 \), \( i = 10\% = 0.1 \), \( n = 3 \) then

Calculator Steps:

\[ 1 + 0.1 \times = = \] (first equal will be considered as power 2, second as 3 and so on) \( \times 1000 \) (Principal)

Note: If question is silent about conversion period, assume it to be yearly

CI Formula

\[ CI = P[(1+i)^n-1] \]

### Example 1: Calculate Amount as per CI and CI

Compute the compound interest on ₹ 4,000 for 1½ years at 10% per annum compounded half-yearly.

### Example 2: Calculate Principal

On what sum will the compound interest at 5% per annum for two years compounded annually be ₹ 1,640?

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### Example 3: Calculate rate of interest

What annual rate of interest compounded annually doubles an investment in 7 years?

### Example 4: Calculate Time Period

In what time will ₹8,000 amount to ₹8,820 at 10% per annum interest compounded half-yearly?

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**Effective rate of interest**

<table>
<thead>
<tr>
<th>Formula</th>
<th>[ E = \left[ (1+i)^n - 1 \right] ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>( n )</td>
<td>Here ( n ) means no. of periods in one year considering the compounding</td>
</tr>
</tbody>
</table>

**Example:**

₹5,000 is invested in a Term Deposit Scheme that fetches interest 6% per annum compounded quarterly. What is effective rate of interest?

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![Cashflow diagram](image-url)
### Formula for Single Cash flow

<table>
<thead>
<tr>
<th>Future Value of Single Cash flow</th>
<th>$FV = PV (1+i)^n$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td>You invest ₹3000 in a two year investment that pays you 12% per annum. Calculate the future value of the investment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Present Value of Single Cash flow</th>
<th>$PV = \frac{FV}{(1+i)^n}$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example</strong></td>
<td>Find the present value of ₹ 10,000 to be required after 5 years if the interest rate be 9%.</td>
</tr>
</tbody>
</table>
## Future Value of Annuity

### Formula for FV of Annuity Regular

\[ FVA = A_i \times [FVAF\ (n,\ i)] \quad \text{or} \quad FVA = A_i \left[ \frac{(1+i)^n - 1}{i} \right] \]

- \( A_i \) = amount of installment or Annuity, \( FVAF \) means future value annuity factor (it's a multiplier used to convert installment to its Future value)

### Example:

₹ 200 is invested at the end of each month in an account paying interest 6% per year compounded monthly. What is the future value of this annuity after 10th payment?

### Formula for FV of Annuity Due

\[ FVA \ \text{Due} = FVA \times (1+i) \]

Calculate FVA regular normally and then multiply it by \((1+i)\)

### Example:

Mr. P invests ₹10,000 every year starting from today for next 10 years. Suppose interest rate is 8% per annum compounded annually. Calculate future value of the annuity.
### Present Value of Annuity

**Formula for PV of Annuity Regular**

\[ PVA = A_1 \times [PVAF(n, i)] \]

**Type 1:**

\[ PVA = A_1 \left[ \frac{(1+i)^n-1}{i(1+i)^n} \right] \]

Or

**Type 2:**

\[ PVA = \frac{A_1}{i} \left[ 1 - \frac{1}{(1+i)^n} \right] \]

- \( A_1 \): amount of installment or Annuity
- \( PVAF \): present value annuity factor (it's a multiplier used to convert installment to its present value)

**Calculator Trick of PVAF (Present Value Annuity Factor)**

\[
\frac{1+i}{\text{GT}} = \cdots n \text{ times}
\]

**Example:**

₹ 5,000 is paid every year for ten years to pay off a loan. What is the loan amount if interest rate be 14% per annum compounded annually?

**Formula for PV of Annuity Due**

PV Regular for one shorter period + Initial Cash flow

**Example:**

₹ 5,000 is paid every year for ten years to pay off a loan starting from today. What is the loan amount if interest rate be 14% per annum compounded annually?