## Finance Basic Formulas

### Simple Interest

#### Formula

\[
SI = \frac{P \times R \times T}{100}
\]

- **SI**: simple interest
- **P**: principal amount
- **R**: interest rate per year
- **T**: time in years

### Compound Interest
Mortgage

Formula

\[ CI = P \left(1 + \frac{r}{n}\right)^{nT} \]

- \( CI \) → compound interest
- \( P \) → principal amount
- \( r \) → \( R / 100 \)
- \( R \) → interest rate
- \( T \) → time in years
- \( n \) → number of compounding frequency per year
**Formula**

\[ \text{Mortgage}_{\text{monthly}} = \text{Principal} \times \frac{r (1 + r)^n}{(1 + r)^n - 1} \]

- \( r \rightarrow R / 100 \)
- \( R \rightarrow \text{interest rate} \)
- \( n \rightarrow \text{number of months or periods} \)

**Equated Monthly Instalment**
Certificate of Deposit

Formula

\[ EMI = \frac{P \times r \times (1+r)^n}{(1+r)^n - 1} \]

- **EMI**: Equal Monthly Instalment
- **r**: \( R / 100 \)
- **R**: Interest rate
- **P**: Principal amount
- **n**: Total number of months
**Formula**

\[ CD = P \left(1 + \frac{r}{n}\right)^{nT} \]

- \( CD \) → Certificate of Deposit
- \( P \) → principal amount
- \( r \) → \( R / 100 \)
- \( R \) → interest rate
- \( T \) → time in years
- \( n \) → number of compounding per year

**Annual Percentage Rate**
**Formula**

\[
\text{APR} \% = \frac{\text{Principal} \times \text{Rate} \times \text{Years}}{100} + \frac{\text{Additional Charges}}{(\text{Principal} \times \text{Years})} \times 100
\]

- **APR**: Annual Percentage Rate
- **Principal**: loan amount
- **Rate**: interest rate per year
- **Years**: number of periods or years

**Annual Effective Rate**
**Formula**

\[
\text{AER (\%) } = \left(1 + \frac{r}{n}\right)^n - 1 \times 100
\]

- **AER** → Annual Effective Rate
- **r** → R / 100
- **R** → interest rate
- **n** → number of compounding per year

**Present Value**
Future Value

\[ PV = \frac{FV}{(1 + r)^n} \]

- **PV** → Present Value
- **FV** → future value
- **r** → \( \frac{R}{100} \)
- **R** → interest or discount rate
- **n** → number of periods or years
### Net Present Value

The Net Present Value (NPV) is a financial metric used to evaluate the profitability of a project or investment. It is calculated by subtracting the present value of the investment's costs from the present value of its expected future returns.

The formula for Net Present Value is:

\[
NPV = \sum_{t=0}^{n} \frac{C_t}{(1+r)^t}
\]

where:
- \(C_t\) is the cash flow at time \(t\)
- \(r\) is the discount rate
- \(n\) is the number of time periods

The NPV is positive when the present value of the future cash flows exceeds the initial investment. A negative NPV indicates that the investment is expected to result in a loss.
**Formula**

\[
\text{NPV} = \left( \sum_{t=1}^{n} \frac{\text{Net Cash Inflow}_t}{(1 + r)^t} \right) - \text{Initial Investment}
\]

- NPV → Net Present Value
- \( t \) → time in years
- \( r \) → \( R / 100 \)
- \( R \) → interest or discount rate
- \( n \) → number of periods or years

**Inflation**
Annuity

Annuity = PV × \( \frac{r}{1 - (1 + r)^{-n}} \)

- **Annuity** → Monthly Annuity Payment
- **r** → R / 100
- **R** → interest or discount rate
- **n** → number of periods

Perpetuity
Present Value of Annuity

**Formula**

\[ PV \text{ of Perpetuity} = \sum_{n=1}^{\infty} \frac{D}{(1 + r)^n} \]

\[ = \frac{D}{(1 + \frac{R}{100})} + \frac{D}{(1 + \frac{R}{100})^2} + \ldots + \frac{D}{(1 + \frac{R}{100})^n} \]

- **PV** → Present value
- **D** → Dividend
- **r** → \( \frac{R}{100} \)
- **R** → Interest or discount rate
- **n** → Number of years
Future value of Annuity

\[ PVA = \text{Annuity} \left( 1 - \frac{1}{(1+r)^n} \right) \]

\[ PVA = \text{Annuity} \left( \frac{1}{1+(R/100)^n} \right) \]

- PVA → Present Value of Annuity
- Annuity → periodic annuity payment
- r → R/100
- R → interest or discount rate
- n → number of periods
Fixed Deposit

**Formula**

\[
FVA = \text{Payment} \times \left( \frac{(1+r)^n - 1}{r} \right)
\]

\[
FVA = \text{Payment} \times \left( \frac{(1 + (R/100))^n - 1}{R/100} \right)
\]

- **FVA** → Future Value of Annuity
- **Payment** → periodic payment
- **r** → R/100
- **R** → interest or discount rate
- **n** → number of periods
Basic Growth Rate

Formula

\[ FD = P \left(1 + \frac{r}{n}\right)^{nT} \]

- \( FD \) → Fixed Deposits
- \( P \) → Principal amount
- \( r \) → R/100
- \( R \) → interest rate
- \( T \) → time in years
- \( n \) → number of compounding frequency per year
Economy Growth Rate

**Formula**

Basic Growth Rate (%) = \( \left( \frac{\text{Present Value} - \text{Initial Value}}{\text{Initial Value}} \right) \times 100 \)

Average Growth Rate (%) = \( \left[ \left( \frac{\text{Present Value}}{\text{Initial Value}} \right)^{\frac{1}{n}} - 1 \right] \times 100 \)

\( n \)  ➙ number of periods or years
Economy Growth Rate (%){\text{basic}} = \left( \frac{GDP_{pv} - GDP_{init}}{GDP_{init}} \right) \times 100

Economy Growth Rate (%){\text{avg}} = \left[ \left( \frac{GDP_{pv}}{GDP_{init}} \right)^{\frac{1}{n}} - 1 \right] \times 100

GDP_{pv} \rightarrow \text{present value of GDP}

GDP_{init} \rightarrow \text{initial value of GDP}

n \rightarrow \text{number of periods or years}