Mathematics of Finance

Why is interest paid ??

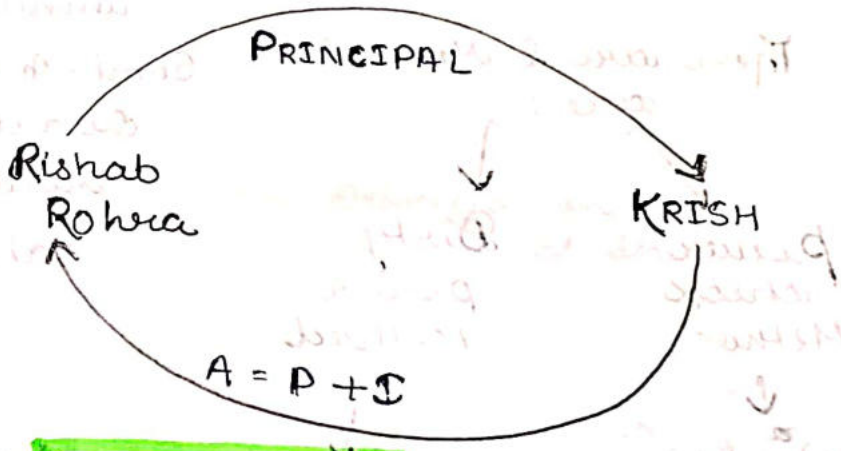
- opportunity cost
- Inflation
- liquidity preference
- Risk factor
- Time value of Money

} lend Money → Return

Interest → Extra Money Receive

Definitions :

- Interest
- Principal
- Accumulated amount (Balance)
- Rate of Interest
- Time period



$$\% = \frac{I}{P} \times 100$$

SIMPLE INTEREST

$$P = S.I = \frac{P \times R \times T}{100}$$

NOTE → Simple interest is calculated on principal for every time period whereas, C.I is calculated on accumulated amount of previous time period.

Compound Interest

$$A = P\left(1+\frac{r}{100}\right)^{t}$$ as per C.I → when compounding annually.

$A = P + C.I$

$C.I = A - P$

$$C.I = P\left(1+\frac{r}{100}\right)^{t} - P$$

$$P\left[1+\frac{r}{100}\right]^{t} - 1$$

Calculator Trick

limitation : when $t \leq 5$ years

$$A = P + \underbrace{r\% + r\% + r\%}_{\geq 5}$$

conversion period

compounding → c → (no. of conversion in year)

Annually :- 1

Semi-Annually :- 2

Quarterly :- 4

Monthy :- 12

Daily :- 365

If question mentioned of C.I not about time period and if assume compound will be annually.

There are 2 Method are :

- Power check Method
- Dirty power Method

Power check Method

$(x)^{a} = (y)^{n}$

$y \times = \cdots\cdots \times$

Power check Method use only when option have no decimal Method.

Dirty power Method

If option have decimal number.

$a^{\frac{1}{n}}$ → Type 'a'

→ '$\sqrt{\ }$' 12 Time.

→ -1

→ $\div n$

→ $+1$

→ '$\times =$' 12 times

LOGARITHM Method

$(a)^{\frac{1}{n}}$ → a

↓

'$\sqrt{\ }$' 15 times

↓

-1

↓

× 14230

Effective Rate of Return

$$\text{Rate of Interest} = \frac{\text{Interest}}{\text{Principle}} \times 100$$

$$E \cdot R \cdot I = \frac{P\left[(1+i)^n - 1\right]}{P} \times 100$$

$$E \cdot R \cdot I = \left[(1+i)^n - 1\right] \times 100$$

Depreciation

SLM
- Simple interest
- Initial value (Assets denying value)

Question Silent
- WDV or Beginning of Each year.

WDV
- Compound interest
- Depreciation charged of initial value of assets in starting of Each year / time period.

Annuity

Annuity regular / Annuity certain
- 1st annuity paid will be in end of first period.

Annuity due / Annuity Immediate
- when first annuity paid is at the start of first period.

Future Value of Annuity Regular

$$FV \text{ of } AR = \frac{A(1+i)^n - 1}{i}$$

Future Value of Annuity Immediate

$$FV \text{ of } AI = \frac{A(1+i)^n - 1}{i} \times (1+i)$$

Present Value of Annuity Regular

$$PV \text{ of } AR = \frac{A(1+i)^n - 1}{i(1+i)^n}$$

Present Value of Annuity Immediate

$$PV \text{ of } AI = \frac{A(1+i)^{n-1} - 1}{i(1+i)^{n-1}} + A.$$

Application of Time Value of Money

- Sinking fund → FV of AR
- Leasing → PV
- Capital Expenditure → PV
- Valuation of Bond → PV of An + PV of single Amount
- Perpetuity → PV of infinite payment
- CAGR → Compound interest
- NPV → PV.

Leasing

- owner → lessor ✓
- Borrower → lessee ✓
- Time period → lease period ✓
- Annuity → lease Rental. ✓

In Leasing question agar jab purchase value leh upar rent value aayga toh rent preferable hoga !!!....

Perpetuity

↳ Zindagi ke Sath bhi Zindagi ke baad bhi.....

$$PVA\ \infty = \frac{A}{i}$$ [FOREVER PERPETUITY]

Growing perpetuity

$$PVA\ \infty = \frac{A}{i-g} \cdot [i < g]$$

SOME DEFINATION

- Nominal rate of Return → [offered rate] ↓ wo offered jab Samne leh mila.!!
- Real rate of return ↳ [Inflation adjusted] + [Real Rate ⇒ Int. Rate − Inflati
- Effective rate of return → Effectiveness because of compounding.
- Discounted rate of return → used for calculating present value of future cash flow.

↓ Jab humara future calculating ke liye krte hai ↳ Compounding Rate

Net present value

$$PV = \frac{An}{(1+i)^n} = An \times \underbrace{\frac{1}{(1+i)^n}}_{\text{PVIF}}$$

PVIF → Present value of interest factor.

$$\text{PV of AR} = \boxed{\frac{A(1+i)^n - 1}{i(1+i)^n}}$$

↳ PVFA (Present value ~~fac~~ interest factor accumulated)

t	year	$PV = \frac{1}{(1+i)^n}$

NPV = PV of cash inflow (−) PV of cash outflow

Net present value → PV of C.I (−) PV of C.O

NPV ≥ 0 → preferable → Accept the proposal

NPV ≤ 0 → Not preferable → Reject the proposal.

Valuation of Bond

Bond issue → Maturity period
→ Nominal rate

V.O.B ⇒ PV of Annuity + PV of can amounts

$$= \frac{A(1+i)^n - 1}{i(1+i)^n} + \frac{An}{(1+i)^n}$$ ← Accumulated Amount

CAGR → Compound annual growth Rate

$A = P(1+i)^t$

$$V_n = V_0\left(1 + \frac{CAGR}{100}\right)^{tn-to}$$

$$\text{CAGR} = \left(\frac{V_n}{V_0}\right)^{\frac{1}{tn-to}} - 1 \times 100$$