

## TOPIC

Sales - costs = G.P.

50L - 30L = 20L

# Profitability Ratios Formula

EBIT - Int. Tax = PAT

15L - 2L - 2.60L = 10,40,000  
✓

$$\text{Gross Profit Margin} = \frac{\text{Gross Profit}}{\text{Sales}} \times 100 = \frac{20L}{50L} \times 100 = 40\%$$

$$\frac{15L}{50L} \times 100 = 30\%$$

$$\text{Operating Profit Margin} = \frac{\text{Operating Profit}}{\text{Sales}} \times 100 = \frac{\text{EBIT}}{\text{Sales}} \times 100$$

$$\text{Net Profit Margin} = \frac{\text{Net Income}}{\text{Sales}} \times 100 = \frac{\text{PAT}}{\text{Sales}} \times 100 = \frac{10,40,000}{50,00,000} \times 100 = 20.8\%$$

$$\text{Return on Assets} = \frac{\text{Net Income}}{\text{Assets}} \times 100 = \frac{\text{PAT}}{\text{Assets}} \times 100 = \frac{10,40,000}{100L} \times 100 = 10.4\%$$

$$\text{Return on Equity} = \frac{\text{Net Income}}{\text{Shareholder's Equity}} \times 100 = \frac{\text{PAT}}{\text{Esc + Ris + Profit}} \times 100 = \frac{10,40,000}{30,00,000} \times 100 = 34.67\%$$

## TOPIC

$$\text{Inventory Turnover Ratio} = \frac{\text{Cost of Goods Sold}}{\text{Average Inventory}}$$

$$\boxed{\text{DTR}} \text{ Receivables Turnover Ratio} = \frac{\text{Credit Sales}}{\text{Average Accounts Receivable}}$$

"₹1 blocked in stock generated Sales of ₹10."

$$\Rightarrow \frac{40L}{4L} = 10 \text{ times}$$

$$\Rightarrow \frac{35L}{7L} = 5 \text{ times}$$

"₹1 blocked in debtor generated ₹5 Sales"

Eg:- Sales = 50L  
 Op. Stock = 3L  
 Cl. Stock = 5L  
 G.P. Ratio = 20%  
 Cash Sale = 30% ✓  
 Op. debt = 6L  
 Cl. debt = 8L

IRR  
 ⇒  
 DTR

$$* \text{COGS} = 50L - 20\% = 40L$$

$$* \text{Avg. Stock} = \frac{\text{Op.} + \text{Cl.}}{2} = \frac{3L + 5L}{2} = 4L$$

$$* \text{Credit Sales} = 50L - 30\% = 35L$$

$$* \text{Avg. Debtor} = \frac{\text{Op.} + \text{Cl.}}{2} = \frac{6L + 8L}{2} = 7L$$



**Average  
Collection  
Period Formula**

Time taken ↓ to collect money



365 Days

**Average Receivable  
Turnover Ratio**



$$= \frac{365}{5 \text{ times}} = \underline{\underline{73 \text{ days}}}$$

## TOPIC

eg: 10% loan 20,00,000 and 14% PSC 10L and EBIT 15,00,000 loan to be repaid in 5 year.

Some Imp Ratio for Bank Purpose

$$\textcircled{1} \text{ Fixed charge Ratio} = \frac{\text{EBIT}}{\text{Interest} + \text{Ref. Div.}} = \frac{15,00,000}{200,000 + 140,000} = 4.41 \text{ times}$$

Best if Above 1.5:1

$$\textcircled{2} \text{ DSCR [Debt Service Coverage Ratio]} = \frac{\text{EBIT}}{\text{Interest} + \text{Installment Principal Amount}} = \frac{15,00,000}{200,000 + 400,000} = 2.5 \text{ times}$$

1.5:1

$$= \frac{\text{EBIT} + \text{Depreciation}}{\text{Int.} + \text{Installment Principal Amount}}$$

$\frac{20,00,000}{5} = 4,00,000$

$$\textcircled{3} \text{ Dividend Yield Ratio} = \frac{\text{DPS}}{\text{MPS}} = \frac{9 \times 60\%}{90} = \frac{5.4}{90} = 6-1$$

eg:- EPS = 9 Pay out @ 60% MPS 90 Find D Y R

## TOPIC

$\Rightarrow$  Fixed Asset Ratio =  $\frac{\text{Fixed Asset}}{\text{Long term liability}} = \frac{\text{4000}}{\text{5000}} = 0.8 \text{ times}$

eg:- FA = 4000 =  $\begin{matrix} \text{Building} \\ \text{Mach.} \\ \text{Furniture} \end{matrix}$   
 LTL = 5000

FA Ratio  $\leq 1$  is good

$\Rightarrow$  Debt-equity Ratio =  $\frac{\text{Long term Debt}}{\text{Shareholder's fund}} = \frac{30L}{15L} = 2:1$

eg:- Debenture = 10L  
 = ✓ Bond = 10L  
 x Bank loan = 5L  
 = ✓ Loan = 10L  
 = ✓ Creditor = 5L x 5 = 15L

ESC = 5L, RIS = 5L, Profit = 5L  
 Shareholder's fund

Best 2:1

## TOPIC

$$\Rightarrow \text{Current Ratio} = \frac{\text{Current Asset}}{\text{Current Liability}} = \frac{30L}{15L} = 2:1$$

$\Rightarrow$  Best Ratio = 2:1

eg:-

Cash	8L	
Debtor	12L	
Stock	10L	
	<u>30L</u>	

Creditor	8L	
Bank O/D	7L	
	<u>15L</u>	

$$\Rightarrow \text{Liquidity Ratio (Quick Ratio)} = \frac{\text{Quick Asset}}{\text{Current Liability}} = \frac{30L - 10L - 5L}{15L} = 1:1$$

$\Rightarrow$  Best 1:1

$$\Rightarrow \text{Quick Asset} = \text{CA} - \text{Stock} - \text{Prepaid Exp.}$$

eg:-

$$30L - 10L - 5L$$

$$CL = 15L$$

$$\Rightarrow \text{Acid test Ratio} = \frac{\text{Cash} + \text{Market Sec.} + \text{Debtors}}{\text{Current Liability}} = \frac{3 + 2.5 + 2}{15L} = 0.5:1$$

$\Rightarrow$  Best Ratio 0.5:1

eg:-

Cash	3L	
market	2.5L	
Deb	2L	

CL = 15L

- ⇒ EMI ✓
- ⇒ Double Period ✓
- ⇒ Simple Interest - Compound Int
- ⇒ Annuity ✓

## Unit 2 - Financial Mathematics — Calculation of Interest And Annuities

## TOPIC

eg:- Personal loan 1,00,000 @ 12-1. P.a. Time 1y. EMI ?

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

No. of months

$\Rightarrow$   $\frac{1}{100} = 0.01$   $\uparrow$   $r = 12-1. = 1.1\%$   
 $\Rightarrow$   $\frac{1.1}{100} = 0.011$   $\uparrow$   $r = 1.1\%$   
 $\Rightarrow$   $\frac{1.1}{100} = 0.011$   $\uparrow$   $r = 1.1\%$

$$(P \times r) \times \frac{(1+r)^n}{(1+r)^n - 1}$$

$$\Rightarrow 100000 \times 1.1 \times \frac{(1+0.01)^{12}}{(1+0.01)^{12} - 1}$$

$$\Rightarrow 1000 \times \frac{1.1268}{0.1268} = 8887$$

$\Rightarrow$   $\boxed{1.01} \times \boxed{= 11 \text{ times}} \div \boxed{0.1268} \times \boxed{1000} = \boxed{8887}$   
 $\Downarrow$   
 Calculator

$$\begin{aligned} (1.01)^{12} &= 1.1268... \\ - 1 &= 0.1268 \end{aligned}$$

# TOPIC

$$\text{Time } 10\text{y} \times 12 = 120 \text{ months}$$

$$E = P \times r \times \frac{(1 + r)^n}{(1 + r)^n - 1}$$

$$120 = 12 \times 10$$

Where,

$E$  is the EMI

$P$  is the principal amount

$r$  is the monthly rate of interest

$n$  is the number of months

$$20,00,000 \times 2.1\% = 420000$$

$$(1 + 0.02) \times 1.2682 \times 10.765 \div 9.765 \times 40.000 = 44096$$

$$\Rightarrow (20L \times 2.1\%) \times \frac{(1.02)^{120}}{(1.02)^{120} - 1}$$

## TOPIC

✓ Doubling Period:- eg:- 200 invested @ 12%. Time taken to double it?

The Rule of 72 =  $\frac{72}{\text{Rate of Return (\%)}}$

$\Rightarrow \frac{72}{12} = \boxed{6 \text{ year}}$

if ROI = 8% =  $\frac{72}{8} = \boxed{9 \text{ year}}$

Ex:  $\Rightarrow \frac{50,00,000 \times 0.461}{23000}$

$\frac{104}{12} @ 5.51\% \text{ p.a.} = \frac{0.461}{100} = 0.0045 + 1 = (1.0045)^{20}$

$\boxed{1.0045} \times \boxed{11} \times \boxed{9 \text{ time}} \div \boxed{0.7139} = \boxed{2.4007} \times \boxed{23000} = \underline{\underline{55218}}$

1.055-- 1.7139

## TOPIC

### SIMPLE INTEREST?

$$\text{Interest} = \text{Principal} \times \text{Rate} \times \text{Time}$$

Illustration

1. The amount of total interest to be paid,
2. The total amount to be paid back after 2 years,

Given: Principal: 'P' = Rs 60,000, Interest rate: 'R' = 12% = 0.12, Repayment time: 'T' = 2 years

Part 1: Find the amount of interest paid. Interest: 'I' = PRT

$$= \overset{P}{60,000} \times \overset{r}{0.12} \times \overset{T}{2}$$
$$\text{Interest} = \underline{\underline{14,400}}$$

## TOPIC

Int. = 12

60000

Part 2: Find the total amount to be paid back. Total repayments = Principal + Interest

$$= 60,000 + 14,400 \approx$$

$$= 74,400 \Rightarrow \text{Repay Value}$$

COMPOUND INTEREST > Simple Interest =

$$A = P(1 + r)^n$$

$$\begin{aligned} & 60,000 \times (1 + 0.12)^2 = \\ & = 75,264 \\ & - (60,000) \\ & \text{Interest } 15,264 \end{aligned}$$

Special Note When interest is compounded continually compound interest equation takes the

form  $A = Pe^{rt}$  where e is approximately 2.71828 Constant value

eg:-  $P = 60,000$   $I = 12\%$  Time = 2y and compounding continually  
Find Repay Amount and Interest (given:  $e^{0.24} = 1.30$ )

$$\Rightarrow P e^{rt} \Rightarrow \frac{60,000 \times e^{0.12 \times 2}}{e^{rt}} = 60,000 \times e^{0.24} = 60,000 \times 1.30 = 78,000$$

- 60,000

Interest 18,000

## TOPIC

### FIXED AND FLOATING INTEREST RATES

✓ Fixed Rate: In the fixed rate, the rate of interest is fixed. Q 107.

✓ Floating Rate: In the floating rate or variable rate, the rate of interest changes, depending upon the market conditions.  $\updownarrow$   $\updownarrow$

### FRONT-END AND BACK-END INTEREST RATES

→ Not in India

EMI  $\Rightarrow$  Famous in India

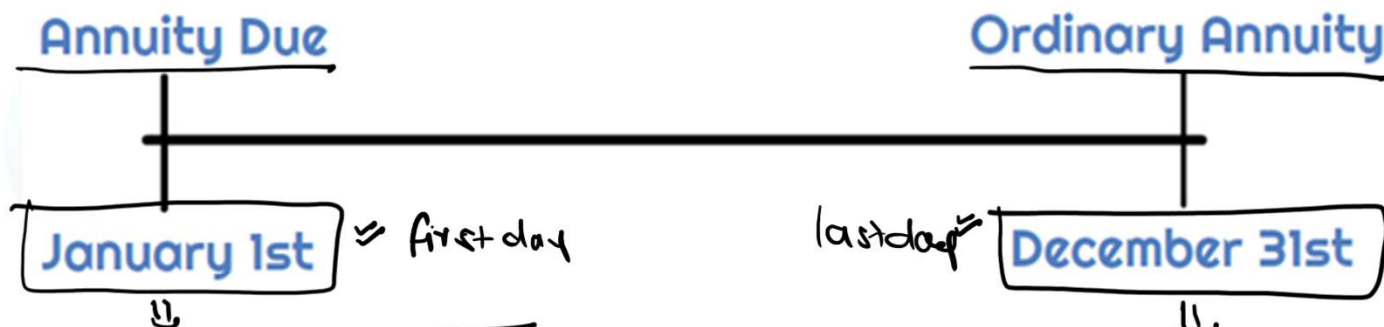
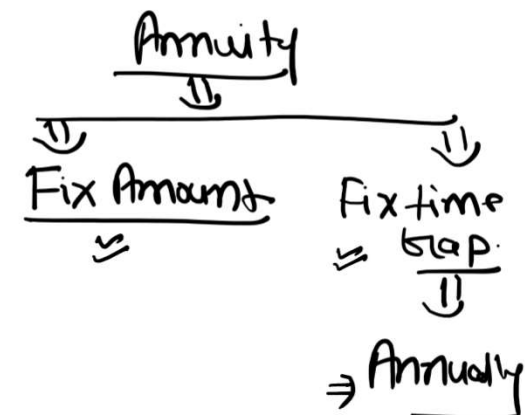
If the interest is deducted from the principal amount and only the net amount is disbursed, it is called front-end interest. The normal practice in banking industry is to charge back-end interest rate which means that the full amount of the loan is disbursed and the interest is charged subsequently on monthly/quarterly/agreed basis.

Front end:  $50,00,000 + 20,00,000 \Rightarrow$  Loan Amount  $70,00,000 - \overset{\text{Up front}}{\underset{\uparrow}{20,00,000}} = \overset{\text{In hand}}{50,00,000}$

Back End:  $= \text{Prin} + \text{Int} = \text{EMI} \checkmark$

# Ordinary Annuity vs Annuity Due

For annuity due, payment is due at the beginning of each period (e.g. January 1st). For an ordinary annuity, payment is due at the end of each period (e.g. December 31st)



Legend:

- $C$  = Cash flow
- $r$  = Rate of Int.
- $n$  = Time Period

Future Value =

$$C \times \left[ \frac{(1+r)^n - 1}{r} \right] (1+r)$$

Present Value =

$$C \times \left[ \frac{(1+r)^n - 1}{r(1+r)^n} \right] (1+r)$$

Future Value =

$$C \times \left[ \frac{(1+r)^n - 1}{r} \right]$$

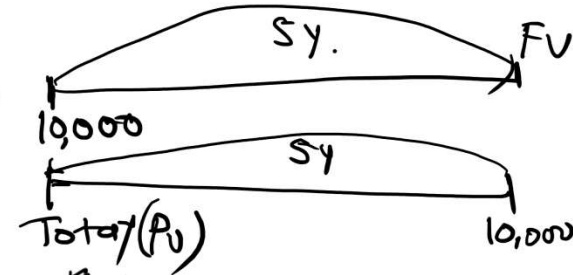
Present Value =

$$C \times \left[ \frac{(1+r)^n - 1}{r(1+r)^n} \right]$$

## TOPIC

eg Cash flow = 50,000  $r = 12\%$  Time 5y

$$(1.12) \times \left(\frac{1}{4}\right) = 1.12 \times 0.12 \times 50000 =$$



$$FV(OA) \Rightarrow C \times \left[ \frac{(1+r)^n - 1}{r} \right] = 50,000 \times \left[ \frac{(1+0.12)^5 - 1}{0.12} \right] = 3,17,642$$

$$PV(OA) \Rightarrow C \times \left[ \frac{(1+r)^n - 1}{r(1+r)^n} \right] = \frac{3,17,642}{(1.12)^5} = 1,80,239$$

$$FV(AD) \Rightarrow C \times \left[ \frac{(1+r)^n - 1}{r} \right] \times (1+r) = 3,17,642 \times 1.12 = 3,55,759$$

$$PV(AD) \Rightarrow C \times \left[ \frac{(1+r)^n - 1}{r(1+r)^n} \right] \times (1+r) = 1,80,239 \times 1.12 = 2,01,868$$

## TOPIC

$$\Rightarrow FV = (1+r)^n$$

$$PV = \frac{1}{(1+r)^n}$$

10,00,000

## Illustration

The population of an industrial town is increasing by 5% every year. If the present population is 1 million estimate the population five years hence. Also, estimate the population three years ago.

## Solution

Present population,  $P = 1$  million, rate of increase = 5% per annum

Hence, the population after 5 years =  $10,00,000 (1.05)^5 = 12,76,280$

Population three years ago =  $10,00,000 / (1.05)^3 = 8,63,838$

Since the population three years ago, compounded at 5 per cent, is equal to 1 million, today.  $\Rightarrow FV = 10L \times (1+0.05)^5 = 12,76,280$

$$FV = 10L \times (1.05)^5 = 12,76,280$$

$$\Rightarrow PV = \frac{10,00,000 \times 1}{(1+0.05)^3} = 8,63,838$$

$$PV = \frac{1}{1.05^3} \times 10L$$