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CA Final SFM

CLASS NOTES

Fast Track Batch
Hindi 2022

CA MAYANK KOTHARI

Time Value of Money

CA Mayank Kothari

- A. Simple Interest $SI = P \times r \times t$
- B. Compound Interest $CA = P\left[1+\frac{r}{n}\right]^{nt}$
- C. Effective Rate of Interest $= \left[1+\frac{r}{n}\right]^{nt} - 1$
- D. Present Value & Future Value $PV = FV \times PVF$
- E. Present Value of Annuity $= A \times PVAF$
- F. Perpetuity $= \frac{CF_1}{r}$
  PV of CF

I = Interest Amount , P = Principal Amount , r = Rate of Interest p.a.

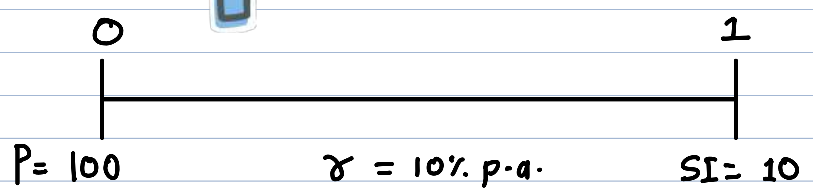
t = period of investment , n= No. of Compounding in a year

A = Annuity , PV = Present Value , FV= Future Value

P = Perpetuity = Present Value of Perpetual Cash Flows

PVF = Present Value Factor, PVAF / PVIF = Present Value Annuity Factor

A. Simple Interest 1



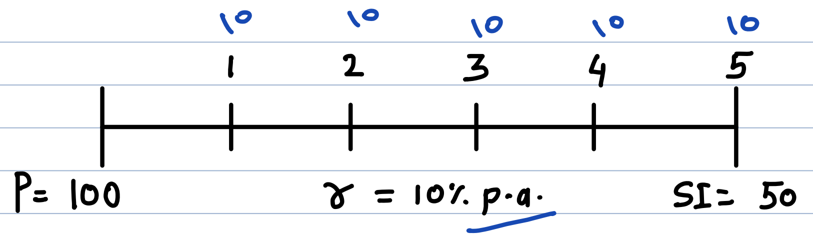
Same

Simple Interest

= p x r x t

= ₹100 x 0.10 x 1

= ₹10



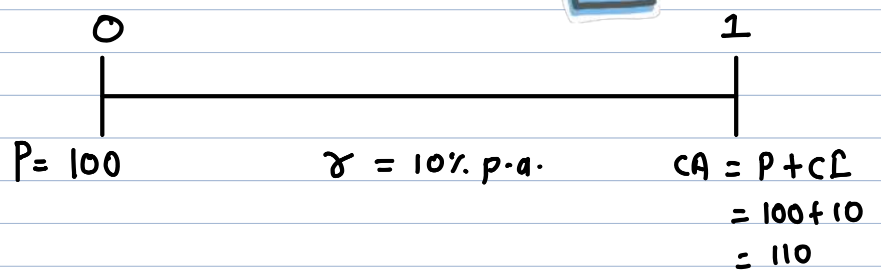
Simple Interest

= p x r x t

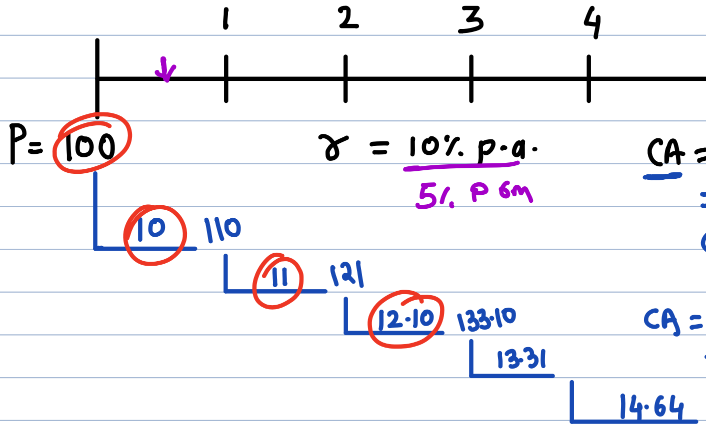
= ₹100 x 0.10 x 5

= ₹50

B. Compound Amount & Compound Interest 2



Annual Compounding



CA = P + CI

= 100 + 61.05

= 161.05

CA = P + SI

= 100 + 50

= 150

$CA = P(1+r/n)^{tn}$

$= 100(1+0.10/1)^{5\times1}$

$= 100 \times 1.6105$

$= 161.05$

$= P[1+r][1+r][1+r][1+r][1+r]$

$= 100 \times 1.1 \times 1.1 \times 1.1 \times 1.1 \times 1.1$

$= 100 \times 1.6105$

$= 161.05$

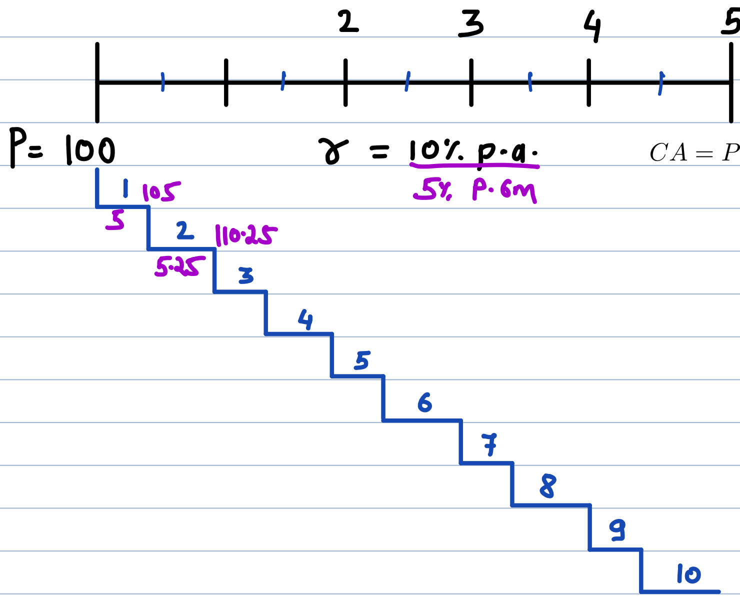
$= P[1+r]^{t}$

$= P\left[1+\frac{r}{n}\right]^{nt}$

$= 100\left[1+\frac{0.10}{2}\right]^{2\times5}$

Semi Annual Compounding

n



$CA = P + CI$

$CA = P(1+r/2)^{tn}$

$= 100(1+0.10/2)^{5\times2}$

$= 100 \times 1.6289$

$= 162.89$

Quarterly Compounding

n = 4

$CA = P(1+r/n)^{tn}$

$= 100(1+0.10/4)^{5\times4}$

$= 100 \times 1.025^{20}$

$= 100 \times 1.6386$

$= 163.86$

Monthly Compounding

n = 12

$CA = P(1+r/n)^{tn}$

$= 100(1+0.10/12)^{5\times12}$

$= 100 \times 1.00833^{60}$

$= 100 \times 1.645$

$= 164.50$

Daily Compounding

n = 365

$CA = P(1+r/n)^{tn}$

$= 100(1+0.10/365)^{5\times365}$

$= 100 \times 1.000274^{1825}$

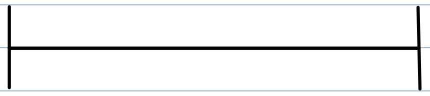
$= 100 \times 1.6487$

$= 164.87$

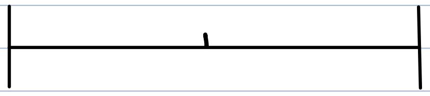
1.0123^{6}

x^{y}

C. Effective Rate of Interest



P= 100 γ=10% n: Annual CA= 110



P= 100 γ=10% n= SemiAnnual

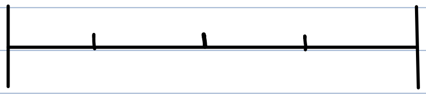
CA $=P(1+r/n)^{tn}$

$=100(1+0.10/2)^{1\times2}$

$=100 \times 1.05^{2}$

$= 100 \times 1.1025$

=₹110.25



P= 100 γ=10% n: Quarterly

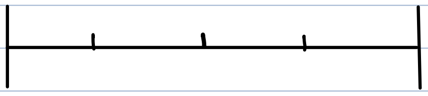
CA $=P(1+r/n)^{tn}$

$=100(1+0.10/4)^{1\times4}$

$=100 \times 1.025^{4}$

$= 100 \times 1.1038$

=₹110.38



P= 100 γ=10% n: Monthly

CA $=P(1+r/n)^{tn}$

$=100(1+0.10/12)^{1\times12}$

$=100 \times 1.0083^{12}$

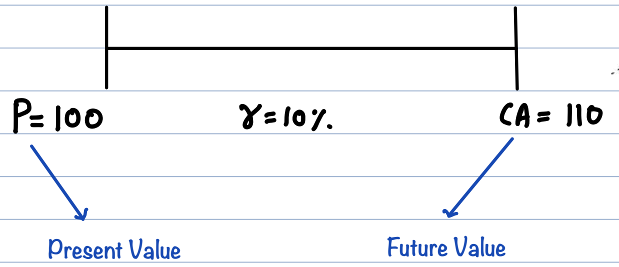
$= 100 \times 1.1043$

=₹110.43

Normal Rate p.a.	Effective Rate p.a. (Annual Compounding)
10% p.a. Annual Compounding	10% p.a. Annual Compounding
10% p.a. Semi-Annual Compounding	(110.25-100)/100 = 10.25% p.a. Annual Compounding
10% p.a. Quarterly Compounding	(110.38-100)/100 = 10.38% p.a. Annual Compounding
10% p.a. Monthly Compounding	(110.43-100)/100 = 10.43% p.a. Annual Compounding

Compounding	Rate	=	Effective Rate	Calculation = $(1+r/n)^{n} - 1$
Annual	10% p.a.	=	10% p.a.	$(1+0.10/1)^{1} - 1 = 0.10$ i.e. 10%p.a.
Semi-Annual	10% p.a.	=	10.25% p.a.	$(1+0.10/2)^{2} - 1 = 0.1025$ i.e. 10.25%p.a.
Quarterly	10% p.a.	=	10.38% p.a.	$(1+0.10/4)^{4} - 1 = 0.1038$ i.e. 10.38%p.a.
Monthly	10% p.a.	=	10.43% p.a.	$(1+0.10/12)^{12} - 1 = 0.1043$ i.e. 10.43%p.a.

D. Present Value & Future Value



$CA = P(1+r/n)^{nt}$ $110 = 100(1+0.10/1)$

In terms of Present & Future Value

$FV = PV(1+r/n)^{nt}$

$PV = FV/(1+r/n)^{nt}$

$PV = FV \times 1/(1+r/n)^{nt}$

$\boxed{PV = FV \times PVF} \rightarrow \frac{1}{(1+r)^t}$

For Annual Compounding & 1 year

$110 = 100 \times \boxed{1.1} \longrightarrow$ FVF

$100 = 110/1.1$

$100 = 110 \times \boxed{1/1.1} \longrightarrow$ PVF

$100 = 110 \times 0.909$

PVF

$1\ Year = 1/(1+0.10)^1 = \underline{0.909}$

$2\ Year = 1/(1+0.10)^2 = 0.826$

$3\ Year = 1/(1+0.10)^3 = 0.751$

$4\ Year = 1/(1+0.10)^4 = 0.683$

$5\ Year = 1/(1+0.10)^5 = 0.621$

$\frac{1}{(1.1)^2} = 0.909$

$\frac{1}{1.21} = 0.826$

$\frac{1}{(1.1)^3}$

$\frac{1}{1.1}$

$= 0.909$

$= 0.826$

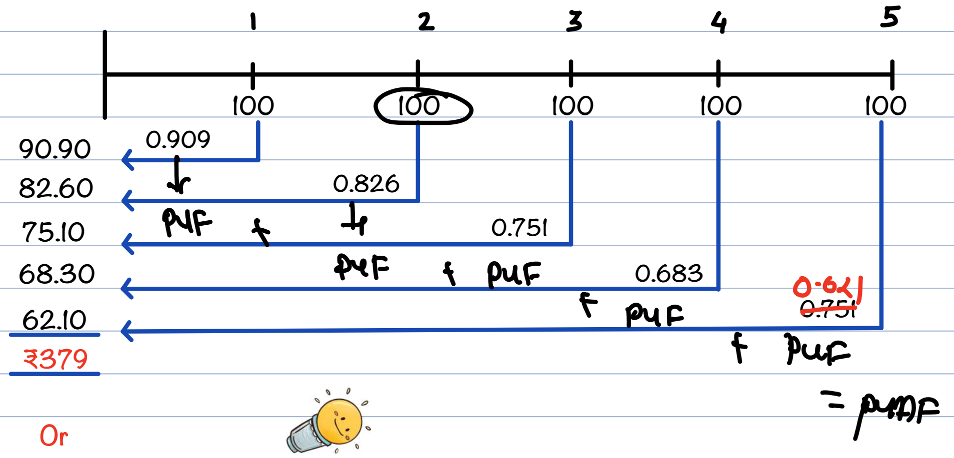
$= 0.751$

$= 0.683$

$= 0.621$

E. Present Value of Annuity

Annuity = ₹100, t= 5 years , r =10% p.a.



90.90
82.60
75.10
68.30
62.10
₹379

Or

$PV\ of\ Annuity = Annuity \times PVAF_{10\%, 5\ Years}$

$= 100 \times 3.791$

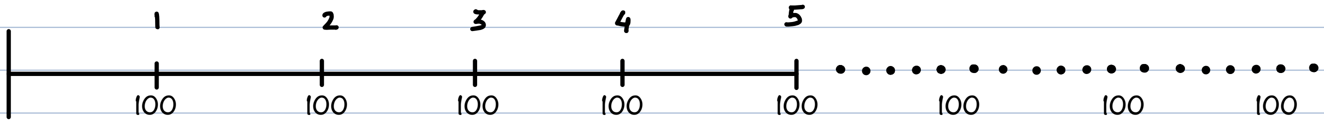
$= ₹379$

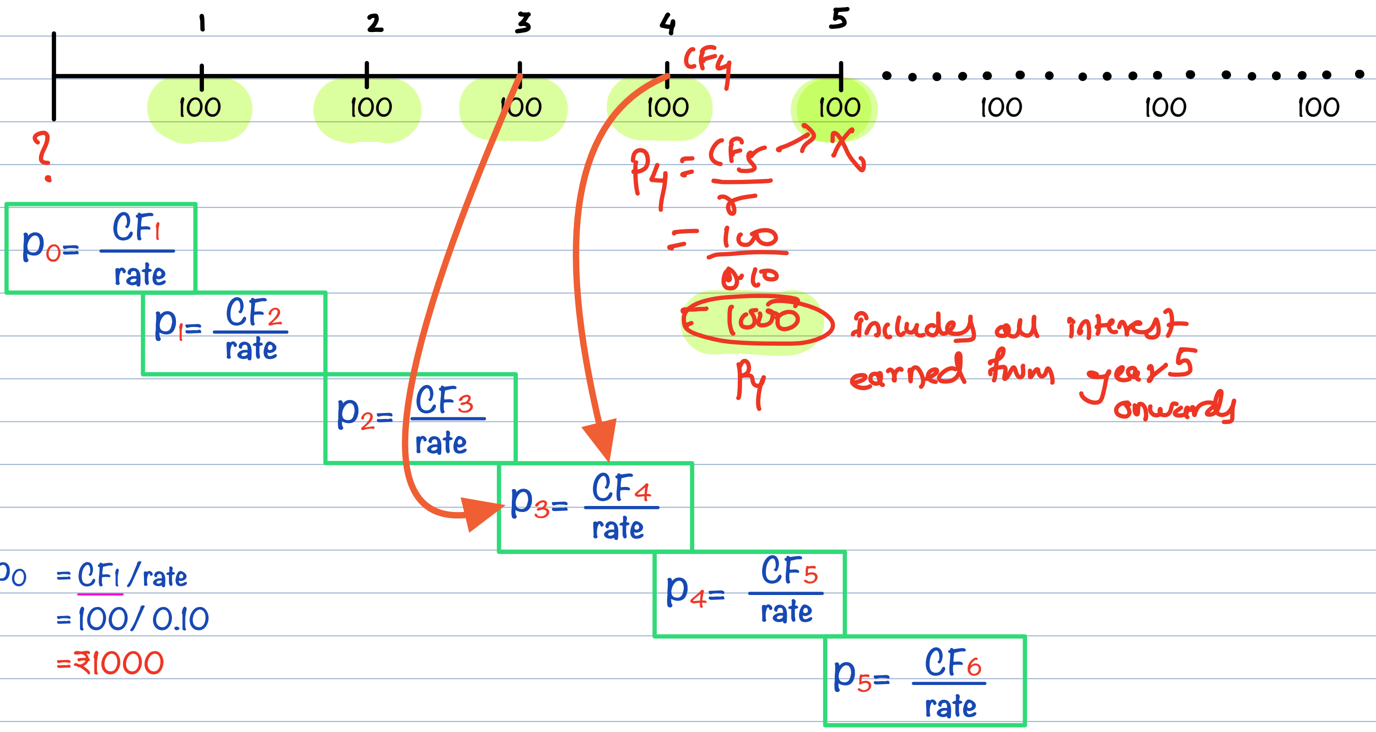
$\longrightarrow$

1/1.10
= M+
= M+
= M+
= M+
= M+
MRC (MemoryReCall)

F. Perpetuity

Annuity = ₹100, t= Perpetual, r =10% p.a.





p_0 = CF_1 /rate
= 100/ 0.10
= ₹1000

p_0 = $(CF_1 + p_1) \times PVF_1$
= (100+1000) x 0.909
= ₹999.90

p_0 = $(CF_1 \times PVF_1) + [(CF_2 + p_2) \times PVF_2]$
= (100 x 0.909) +(100+1000) x 0.826
= 90.90 + 908.60
= ₹999.50

p_0 = $(CF_1 \times PVF_1) + (CF_2 \times PVF_2) + [(CF_3 + p_3) \times PVF_3]$
= (100 x 0.909) + (100+0.826) +(100+1000) x 0.751
= 90.90 +82.60 + 826.10
= ₹999.60

1 2 3 4 5y.......
p_0 = $(CF_1 \times PVF_1) + (CF_2 \times PVF_2) + (CF_3 \times PVF_3) + [(CF_4 + p_4) \times PVF_4]$
= (100 x 0.909) + (100+0.826) + (100+0.751) + (100+1000) x 0.683
CF4 + P4
= 90.90 +82.60+75.10 + 751.30
= ₹999.90

p_0 = $(CF_1 \times PVF_1) + (CF_2 \times PVF_2) + (CF_3 \times PVF_3) + (CF_4 \times PVF_4) + [(CF_5 + p_5) \times PVF_5]$
= (100 x 0.909) + (100+0.826) + (100+0.751) + (100 x 0.683) + (100+1000) x 0.621
= 90.90 +82.60+75.10 + +68.30+ 683.10
= ₹1000

$P = 100$ $r = 10\%$ $t = 1$ Annual $CA = 110$

$P = 100$ $r = 10\%$ $t = 1$ Semi Annual $CA = 110.25$

$P = 100$ $r = ?$ $t = 1$ Annual $CA = 110.25$

$$r = \frac{CI}{P} = \frac{CA - P}{P} = \frac{110.25 - 100}{100} = \frac{10.25}{100} = 10.25\% \text{ p.a.}$$

Effective rate of Interest

10.25% p.a. or 10% p.a.

Annual — 110.25

Semi Annually — 110.25

$$CA = P\left[1+\frac{r}{n}\right]^{n\times t}$$

$$\frac{CA}{P} = \left[1+\frac{r}{n}\right]^{n\times t}$$

$$\frac{P+CI}{P} = \left[1+\frac{r}{n}\right]^{n\times t}$$

$$\frac{P}{P}+\frac{CI}{P} = \left[1+\frac{r}{n}\right]^{n\times t}$$

$$1 + \text{Effective rate of Interest} = \left[1+\frac{r}{n}\right]^{nt}$$

$$\boxed{\text{Effective rate of Interest } [p.a] = \left[1+\frac{r}{n}\right]^{nt \leftarrow 1} - 1}$$

$$= \left[1+\frac{0.10}{2}\right]^{2\times 1} - 1$$

$$= 1.05^{2} - 1$$

$$= 1.1025 - 1$$

$$= 10.25\%$$

$$= \left[1+\frac{0.10}{4}\right]^{4} - 1$$

$$= (1.025)^{4} - 1$$

$$= 1.1038 - 1$$

$$= 10.38\% \text{ p.a.}$$

$(1+r) = FVF$

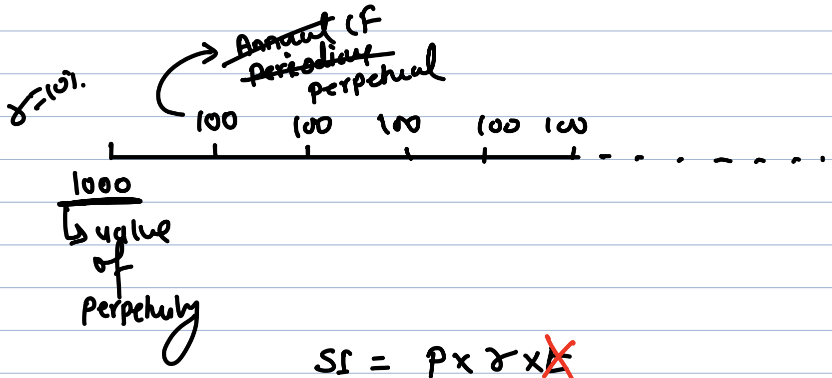
$110 = 100 \times 1{\cdot}10$

$FV = PV \times (1+r)$

$= PV\left[1+\frac{r}{n}\right]^{nt}$

$PV = \frac{FV}{\left[1+\frac{r}{n}\right]^{nt}}$

$= FV \times \underbrace{\frac{1}{\left[1+\frac{r}{n}\right]^{nt}}}_{PVF}$



$SI = P \times r \times \cancel{t}$

Periodical CF = value of perpetuity $\times r$

$$\boxed{p = \frac{\text{periodical CF}}{r}}$$

$1000_0 = \frac{100_1}{0{\cdot}10}$

$P_0 = \frac{CF_1}{r}$

$$P_1 = \frac{CF_2}{\gamma}$$

$$P_4 = \frac{CF_5}{\gamma}$$

$$\begin{array}{r} 2 \\ \times 5 \\ \hline 10 \end{array} + \begin{array}{r} 2 \\ \times 4 \\ \hline 8 \end{array} + \begin{array}{r} 2 \\ \times 3 \\ \hline 6 \end{array}$$

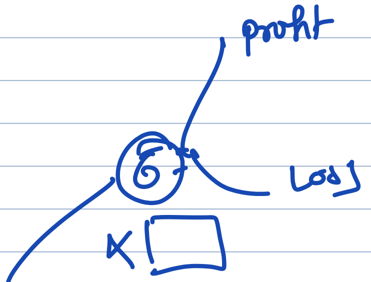
$$\begin{array}{r} 2 \\ \times 12 \\ = 24 \end{array}$$

$$24 = 2 \times 12$$

Basics before

Risk Management

Chapter



= VAR

VaR = Loss

1. **Return** ✓ $\frac{D+CA}{II}$, $R = \sum R_i P_i$
2. **Standard Deviation** $\sigma =$ wp $= \sqrt{\sum (R_i - \bar{R_i})^2 p}$, wop $= \sqrt{\frac{\sum (R_i - \bar{R_i})^2}{N}}$
3. **Portfolio Return** $R_p = \sum R_i \times W_i$ = weighted Avg.
4. **Portfolio Standard Deviation** [Risk] $\sigma_p = \sqrt{(\sigma_a w_a)^2 + (\sigma_x \omega_x)^2 + 2\sigma_a \omega_a \sigma_x \omega_x \gamma_{ax}}$
5. **Correlation** γ_{AB} −1 +1
6. ~~Covariance~~

Dividend = 10

MP: 100 MP: 120

20 = capital Appreciation x

20 = capital gain tax

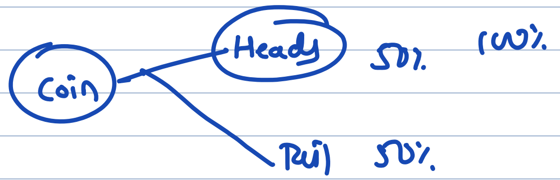
$$ROI = \frac{Return}{Investment} = \frac{CA + D}{II} = \frac{20+10}{100} = \frac{30}{100} = \boxed{30\%}$$

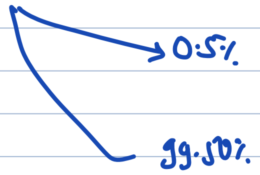
MP: 100

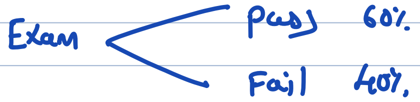
	R	%	Prob.	R×P
MP= 120	20	20%	0.20	4
140	40	40%	0.20	8
150	50	50%	0.20	10
90	−10	−10%	0.20	−2
80	−20	−20%	0.20	−4
		$\Sigma = \frac{80}{n}$		16%

Expected Return $= \sum R_i P_i = 16\%$ $\frac{80}{5}$

= 16%







ii] Standard Deviation = Risk = σ = Non Negative

R_i	Prob.	$\bar{R}_i$	$R_i - \bar{R}_i$	$(R_i-\bar{R}_i)^2$	$(R_i-\bar{R}_i)^2 P$
20	0.20	4	5	25	5
40	0.30	12	25	625	187.5
50	0.10	5	35	1225	122.50
-10	0.20	-2	-25	625	125
-20	0.20	-4	-35	1225	245
	1.00	Σ 15%			

$\sigma^2 = \Sigma 685$ = variance

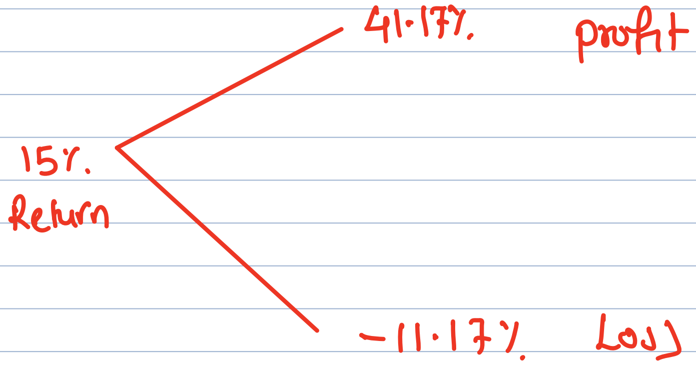
$\sigma = \sqrt{685}$ = 26.17% Standard Deviation

5% -5% Accident 5%

-5% loss 5%

-10% Fire 10%

-2 Square $\sqrt{4}$ sq Root 2



26.17%
SD

$$SD[\sigma] = \sqrt{\sum (R_i - \bar{R_i})^2 \text{prob.}}$$ with prob.

①

②

③

④

⑤

$$= \sqrt{\frac{\sum (R_j - \bar{R_j})^2}{N}}$$ without prob.

portfolio

p = 1000000
- → 500000 Equity
- → 300000 Real Estate
- → 200000 FD

Equity →

①

TATA Motors	100000	-10000
Infosys	100000	
Sunpharma	100000	
Reliance	100000	
Adani Enterp.	50000	
Paytm	50000	

Risk Reduction
Diversification

② TATA Motors 500000 -50000

3. Portfolio Return = $\frac{\text{Return}}{\text{Investment}} = \frac{157000}{1000000} = 15.70\%$

			Return	weight	R×W
ABC	100000 →	12%	~~12000~~	0.10	1.20
XYZ	200000	10%	~~20000~~	0.20	2.00
PQR	300000	15%	~~45000~~	0.30	4.50
DEF	400000	20%	~~80000~~	0.40	8.00
	1000000		~~157000~~		15.70%

X

$R_p = \Sigma R_i \times W_i$

$\gamma_{AX} = 0.60$

		R_i	σ_i	w_i	R_iw_i	σ_iw_i
600000	ABC	10%	① 12%	③ 0.60	6	7.20
400000	XYZ	20%	② 15%	④ 0.40	8	6.00
1000000			?		14%	13.20%
					R_p	~~σ_p~~

ABC XYZ ⑤ $\gamma_{AX} = 1$ ABC +10% −10% xyz +10% −10% ↗ ↗ ↘ ↘

TCS Infosys

0.80 +1

Equity Gold $= -1$ ABC 10% −10% xyz −10% 10% ↗ ↘ ↘ ↗

Equity cash $= 0$ ABC 10% −10% 0 0

ABC xyz

Equity cash

−1 ——— 0 ——— +1

Perfectly Negatively correlated

Uncorrelated

Perfectly positively correlated

ABC 10% ↑ ↓

× 0.60

xyz 6% ↑ ↓

$$\text{Portfolio Variance } \sigma_p^2 = (\overset{ABC}{a} + \overset{xyz}{b})^2$$

$$= a^2 + b^2 + 2ab$$

$a = \sigma_A w_A$

$b = \sigma_x w_x$

$$= (\sigma_A w_A)^2 + (\sigma_x w_x)^2 + 2\sigma_A w_A \sigma_x w_x \gamma_{AX}$$

$$= (12 \times 0.60)^2 + (15 \times 0.40)^2 + 2 \times 12 \times 0.60 \times 15 \times 0.40 \times 0.60$$

$$= 51.84 + 36 + 51.84$$

$$\sigma_p^2 = 139.68$$

$$\text{Standard Deviation} = \sqrt{\sigma_p^2} = \sqrt{139.68} = 11.82\%$$

Basics before

Risk Management

Chapter

1. Return $wop = \frac{D+CA}{II}$, $wp = \sum R_i \times P_i$
2. Standard Deviation $= Risk = \sigma$ $wp\ \sigma = \sqrt{\sum(R_i - \bar{R_i})^2 P}$ $wop\ \sigma = \sqrt{\frac{\sum(R_i - \bar{R_i})^2}{N}}$
3. Portfolio Return $R_p = \sum R_i w_i$
4. Portfolio Standard Deviation $\sigma_p = \sqrt{(\sigma_1 w_1)^2 + (\sigma_2 w_2)^2 + 2\sigma_1 w_1 \sigma_2 w_2 \gamma_{12}}$
5. Correlation
6. ~~Covariance~~

Div = 10

0 1

Equity −100 120 = 20 unrealised gain capital Appreciation [sold share] No tax

20 realised capital gain [sold] Tax

$ROI = \frac{Return}{Investment} = \frac{DIV + CA}{II} = \frac{10 + 20}{100} = \frac{30}{100} = 30\%$

Expected Return

−100 120

14%

	D+CA Rs.	%.	Prob.	RiPi
120	20	20%	0·20	4
130	30	30%	0·20	6
150	50	50%	0·20	10
90	−10	−10%	0·20	−2
80	−20	−20%	0·20	−4

$\frac{\sum 70}{5}$ $\boxed{14\%}$

$$\frac{100\%}{5} = 20\%$$

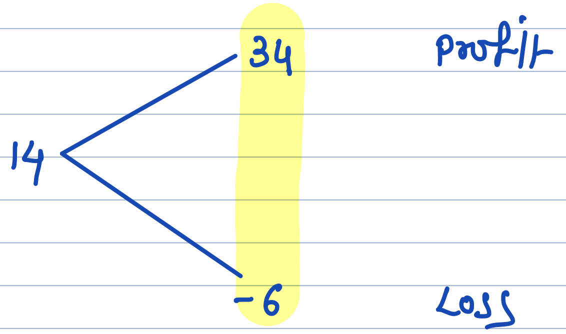
$= 14\%$

Expected Return

$$\text{Return} = \text{WOP} = \frac{D + CA}{IC}$$

$$wp = \Sigma R_i \times P_i$$

2. SD = 20%
॥
Risk



Puncture ~~plat~~ = 5% -5%

Loss = 2% -2%

Earthquake = 3% -3%

R_i	P_i	R_iP_i	$R_i - \bar{R_i}$	$(R_i-\bar{R_i})^2$	$(R_i-R_i)^2P$
20	0·20	4	8	64	12·80
30	0·30	9	18	324	97·20
50	0·10	5	28	784	78·40
-10	0·20	-2	-22	484	96·8
-20	0·20	-4	-32	1024	204·80
	1·00	$\bar{R_i}$ 12%			

$n = 5$

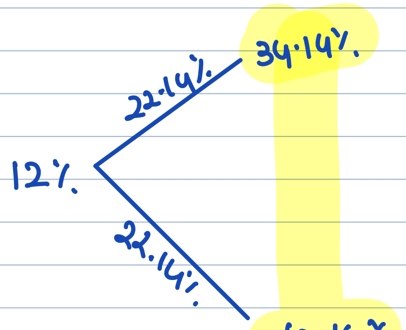
variance = σ^2 490

$$SD = \sqrt{\text{variance}}$$
$$= \sqrt{490}$$
$$= 22·14\%$$

$2 \times 2 = 4$

$-2 \times -2 = \sqrt{4} = 2$

✓ X



$$\sigma = \sqrt{\sum (R_i - \bar{R}_1)^2 \text{prob.}} \quad \text{or} \quad \sqrt{\frac{\sum (R_i - \bar{R}_1)^2}{N}}$$

① ______

② ______

③ ______

④ ______

⑤ ______

$$= \sqrt{\sum (R_i - \bar{R}_1)^2 p}$$

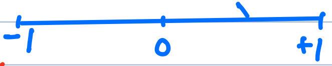
	W_i	R_i	$R_i w_i$	σ_i	$\sigma_i w_i$
ABC	0.60	12	7.2	15%	9
xyz	0.40	10	4.00	20%	8
	1.00		$R_p = 11.20$		$\sigma_p = 17\%$

$\sigma_p = 15.24\%$

Correlation coefficient

$\gamma_{AX} = 0.60$

$r_{AX}: 0.60$



ABC = 10% xyz = 6%

ABC	xyz		ABC	xyz	
Infosys	TCS	= +1 perfectly positively	10% -10%	= 10% -10%	Same Same
stock market	Gold	= -1 Perfectly Negatively	10% -10%	-10% 10%	opposite opposite
Stock Market	Cash	= 0 Uncorrelated	10% -10%	0% 0%	No impact No impact

Equity 500000 → Portfolio

FD 200000

Real Estate 300000

1000000

Portfolio

TATA Motors	100000	-10000
Infosys	50000	✓
ICICI BANK	50000	✓
Paytm	200000	✓
Sun pharma	100000	
	500000	-10000

→ TATA Motors ✓ 500000 -50000

Auto
10% b

Reduce
Risk
Diversification

iii] Portfolio Return

		Ri		Wi	RiWi
ABC	~~600000~~	12%	~~72000~~	0.60	7.2
xyz	~~400000~~	10%	~~40000~~	0.40	4.0
	1000000		~~112000~~		11.20%
	Investment		~~Return~~		

$$R_p = \frac{\text{Return}}{\text{Investment}} = \frac{112000}{1000000} = 11.20\%$$

$$= \Sigma R_i W_i$$

a = ABC, b = xyz

$a = \sigma_A W_A$ $b = \sigma_x W_x$

$$= (a+b)^2$$

$$= a^2 + b^2 + 2ab$$

$$= [\sigma_A W_A]^2 + [\sigma_x W_x]^2 + 2\,\underline{\sigma_A W_A}\,\underline{\sigma_x W_x}\,\gamma_{Ax}$$

$$= [15 \times 0.60]^2 + [20 \times 0.40]^2 + 2 \times 15 \times 0.60 \times 20 \times 0.40 \times 0.60$$

$$= 81 + 64 + 86.40$$

portfolio variance $\sigma_p^2 = 231.40$

SD $\sigma_p = \sqrt{\text{variance}}$

$= \sqrt{231.40}$

$\sigma_p = 15.21\%$

Risk Management

VAR

Z score

- ✓1. Confidence Interval] Range
- ✓2. Confidence Level] 90%
- ✓3. Level of Significance] α
- 4. Normal Probability Distribution ✓ Rejecting Null Hypot.
- 5. Mean μ
- 6. Standard Deviation (Volatility) σ
- 7. Z Table
- 8. Z Score
- 9. VAR

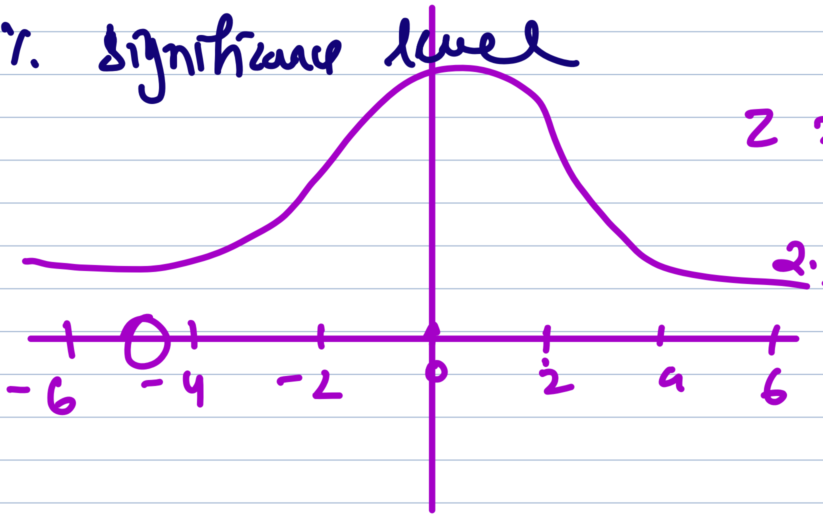
$$Z = \frac{x-\mu}{\sigma} = -1.875$$

FD → 3.04%

NOFD → 96.96%

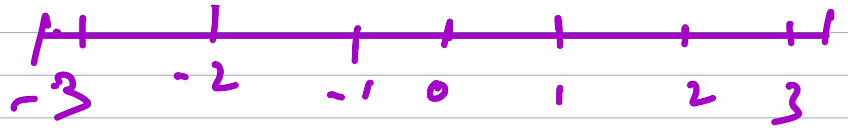
VAR of ₹ 433000 with 90% confidence level

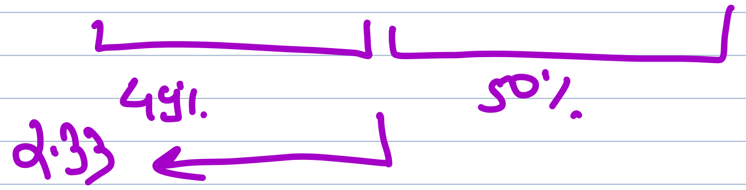
10% significance level

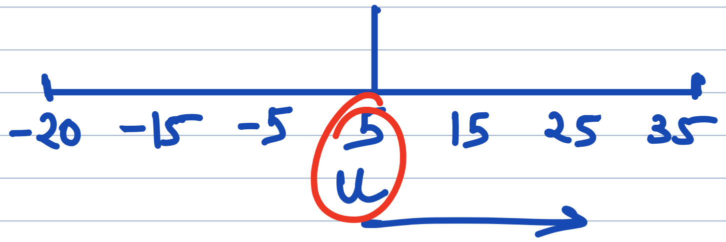


$$Z = \frac{x-\mu}{\sigma}$$

$$2.33 = \frac{x-0}{2}$$







$\sigma = 10$
rs. coin

How many coins are required so that I have a total profit of rs. 25

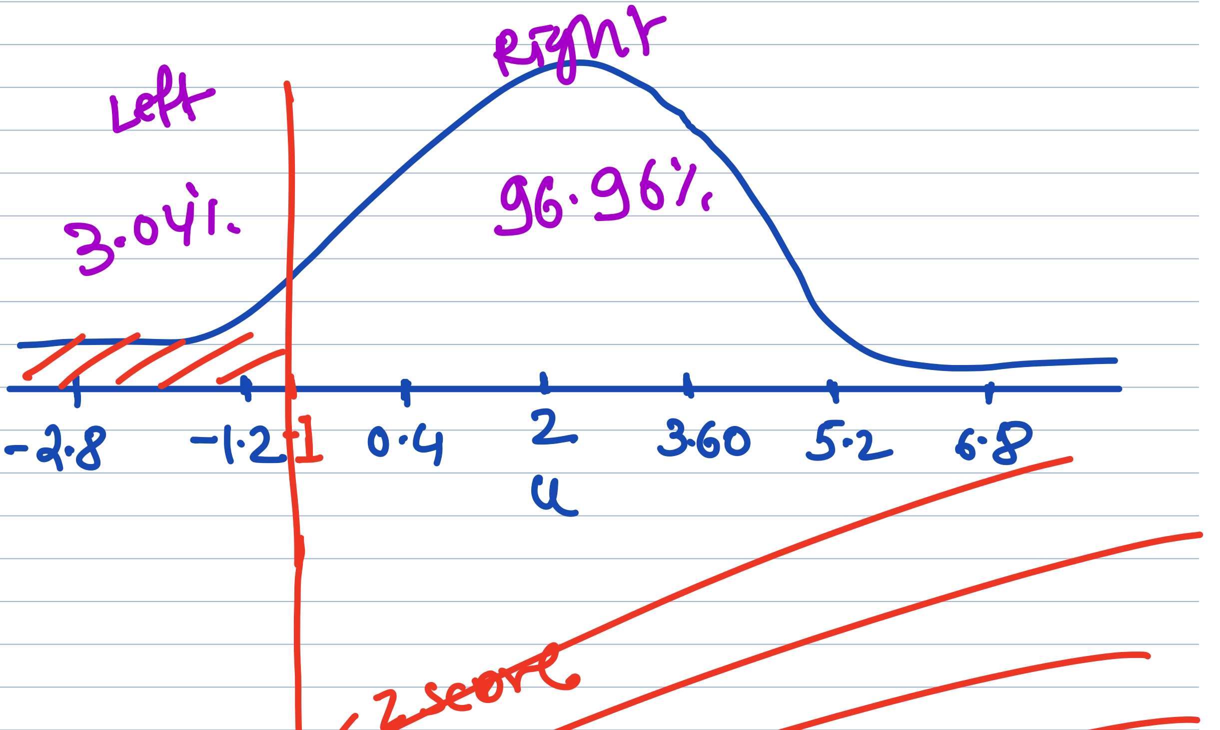
$$\underset{x-u}{25-5} = \frac{20}{10} = 2 \text{ coin}$$

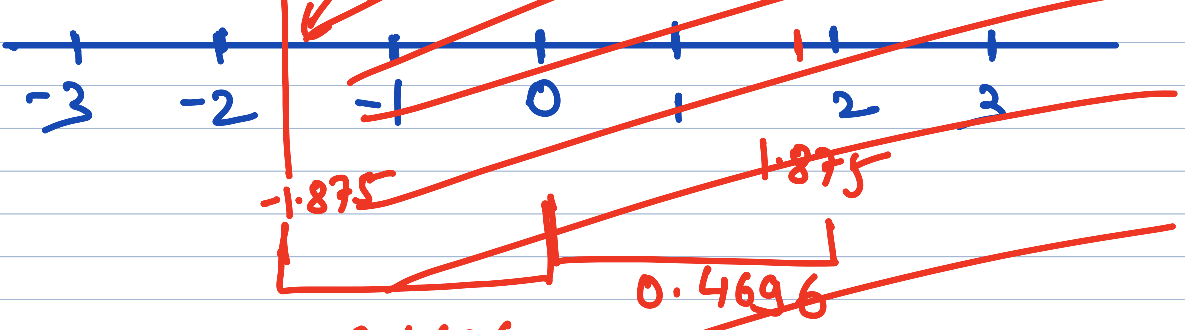
↓

z score

$$\boxed{z = \frac{x-u}{\sigma}} = \frac{25-5}{10} = \frac{20}{10} = 2$$

$\sigma = 1.60$





$0.4696 + 0.50 = 0.9696$

$1 - 0.9696 = \underline{3.04\%}$

$\sigma \quad 20$

$\downarrow$

$\sigma_1^2 \quad \underline{400}$

$\sigma_{10}^2 = 400 \times 10$

$= \sqrt{4000}$

$= 63.25$

$\sigma_{10} = \sigma_1 \sqrt{t}$

$\text{VAR}_{10\text{ days}}$: $\text{SD}_{10\text{ days}} \times$ Z score

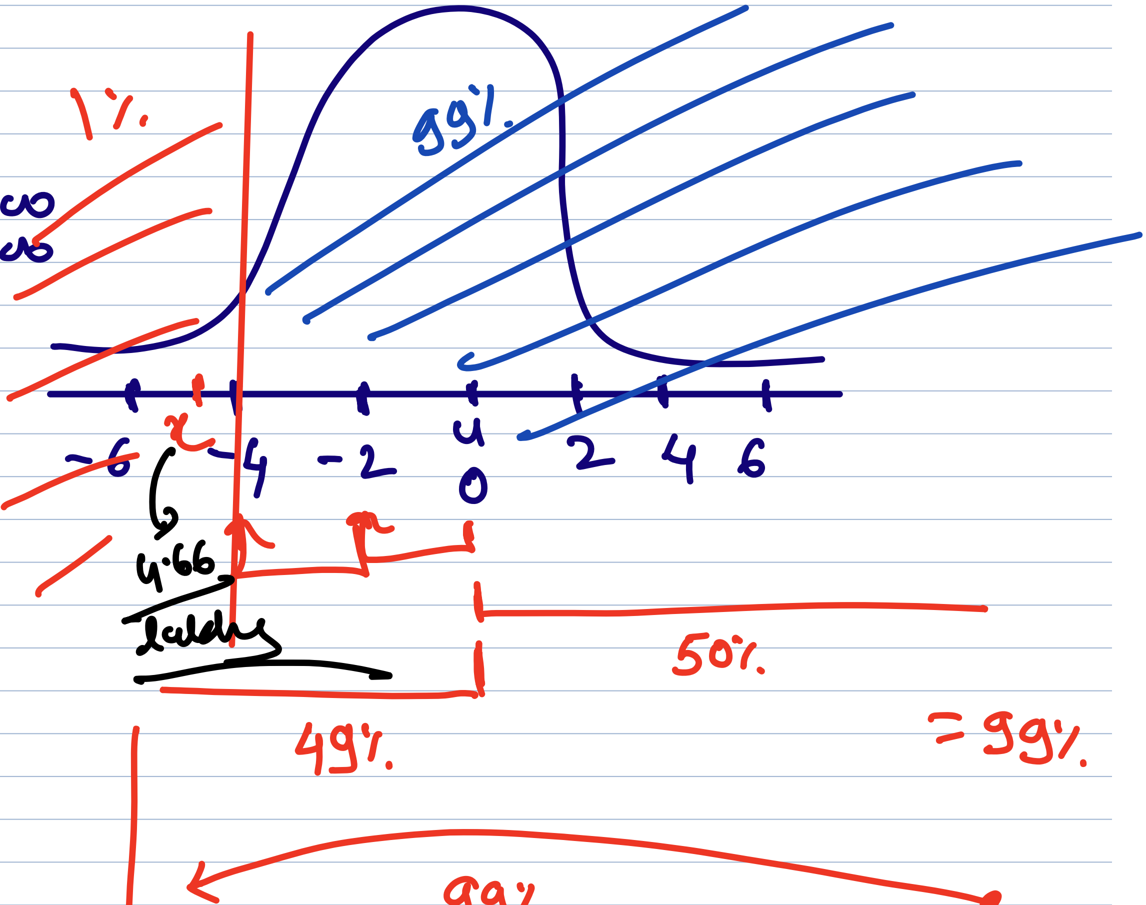
$= \underline{\text{SD}_{1\text{ day}}} \times \sqrt{t} \times \underline{\text{Z score}}$

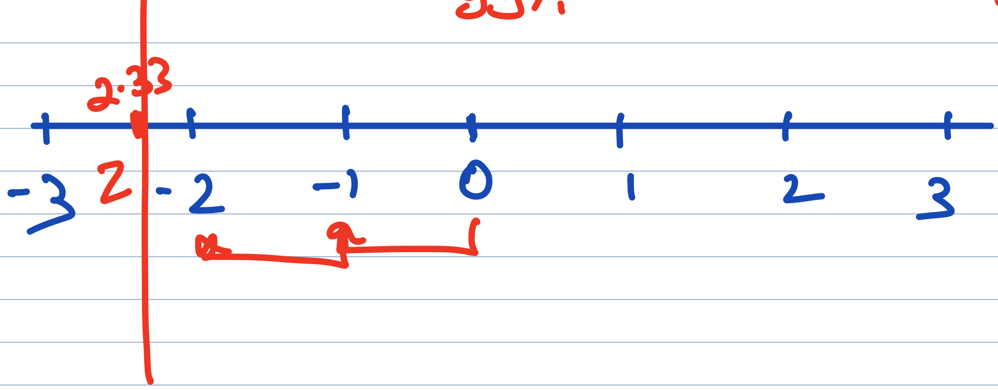
$= VAR_{1\,day}\sqrt{t}$

Investment } = 1000000
SD, 2% } = 200000
VAR_1

VAR_{10}

99%





$$z = \frac{x-u}{\sigma} = \frac{-1-2}{1{\cdot}6} = \frac{-3}{1{\cdot}6} = 1{\cdot}875$$

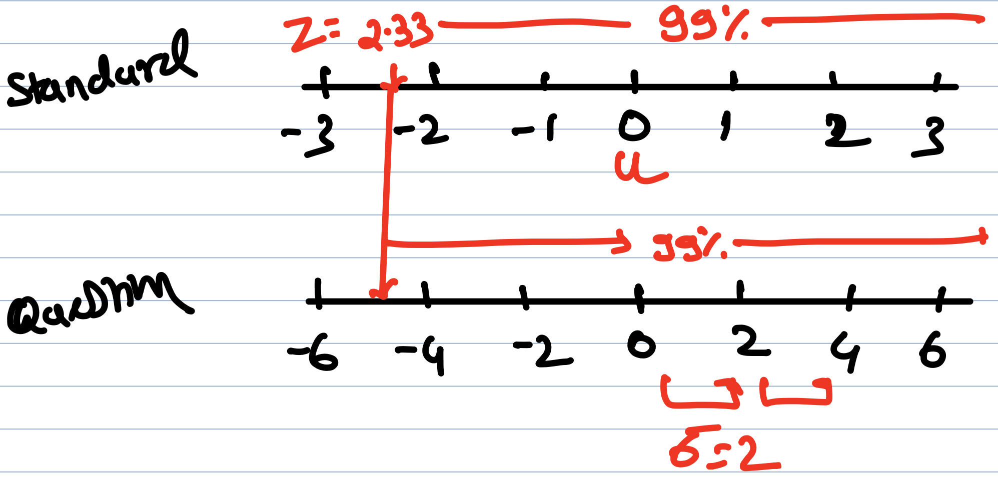
2·33

$$z = \frac{x-u}{\sigma}$$

$$2{\cdot}33 = \frac{x-0}{2}$$

$$2{\cdot}33 \times 2 = x$$

VARy $x = 4{\cdot}66$



$Z =$

5 25

10

$$\underset{x}{\underset{\downarrow}{25}}-\underset{u}{\underset{\downarrow}{5}}=\frac{20}{\underset{6}{\underset{\downarrow}{10}}}=2 \quad 2\text{ score}$$

$$Z=\frac{x-u}{6}$$

$$2.33=\frac{VAR-0}{2}$$

$$\boxed{VaR = Z\text{ score} \times SD}$$

$$VAR_{1\,day} : Z\text{ scre} \times SD_{1\,day}$$

$$VAR_{10\,day} : 2\text{ score} \times SD_{10\,days}$$

✓ ✓ ✓

$$\downarrow$$

$$SD_{t\,days} = SD_1 \times \sqrt{t}$$

time

$SD_{1\,day}$ $\quad$ 2 lakh $\quad$ 2 lakh

t $\quad$ $\times 10$ $\quad$ $\times\sqrt{10}$

$SD_{10\,days}$ $\quad$ 20 lakh $\quad$ $\boxed{6.32 \text{ lakh}}$

✗ $\quad$ ✓

SD $\quad \sigma = 2$

$\downarrow$

Variance $\sigma^2 = 4$

$$
\begin{array}{ll}
\text{Variance}_{1\,day} & 4 \\
\times\ 10 & \times 10 \\
\hline
\text{Variance}_{10\,day} & 40
\end{array}
$$

✓

$\sigma^2 \rightarrow \sqrt{\sigma}$ $\quad$ $\boxed{6.32}$

$$\sigma_{10\,days} = 6.32$$

$$= \sqrt{40}$$

$$= \sqrt{4 \times 10}$$

$$= \sqrt{2^2 \times 10}$$

$$= \sqrt{\sigma_1^2 \times t}$$

$$\sigma_{10days} = \sqrt{\sigma_1^2} \times \sqrt{t}$$

$$\boxed{\sigma_{10days} = \sigma_{1day}\sqrt{t}}$$

① $VAR_{10days} = Z \text{ score} \times SD_{10days}$

$= 2.33 \times SD_{1day} \times \sqrt{t}$

$= 2.33 \times 2 \times \sqrt{10}$

$= 14.74$ lakhs

$= Z \text{ score} \times SD_{10days}$

② $VAR_{10days} = Z \text{ score} \times SD_{1day} \times \sqrt{t}$

✓ ③ $VAR_{10days} = VAR_{1day} \times \sqrt{t}$

$= 4.66 \times \sqrt{10}$

$= 4.66 \times 3.16$

$= 14.73$

$$Z = \frac{x - u}{\sigma}$$

$$Z = \frac{VAR - u}{SD} \text{......} $$ (always 0)

$$VAR_{1\,day} = Z\ score \times SD_{1\,day}$$

$$VAR_{10\,days} = Z\ score \times SD_{10\,days}$$

$$= Z\ score \times SD_{1\,day} \times \sqrt{t}$$

$$= VAR_{1\,day} \times \sqrt{t}$$

India

1,000	Thousand	3
10,000	10 Thousand	
1,00,000	Lakhs	5
10,00,000	10 lakhs	
1,00,00,000	crore	7
10,00,00,000	10 crore	

USA

1,000	Thousand	3
10,000	10 thousand	
100,000	100 Thousand	
1,000,000	1 Million	6
10,000,000	10 Million	
100,000,000	100 Million	
1,000,000,000	1 Billion	9
10,000,000,000	10 Billion	
100,000,000,000	100 Billion	

1,000, 000, 000, 000   1 Trillion > 12

$$VAR_{10 days} = VAR_{1 day} \times \sqrt{t}$$

$$= Z\ score \times SD_{1 day} \times \sqrt{t}$$

$$= 2.33 \times 50000 \times \sqrt{10}$$

$$\boxed{VAR_{10} = \$ 368405}$$

Beta → Portfolio Management

β
↓
measure of risk

-2 1.2 3 0.7
-0.3

Share Market = β = 1   10%↑ 10%↓

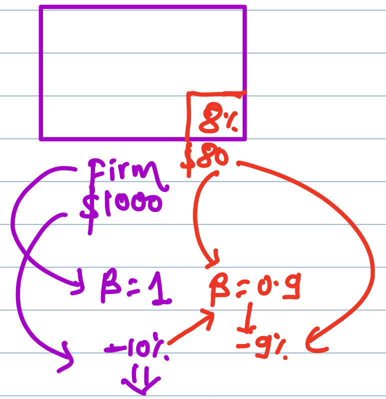
TATA Motors = β = 0.9 → 9%↑ 9%↓

+ve same, -ve opposite → Direction

Extent

= -0.9   9%↓ 9%↑

Infosys = 1.2 → 12%↓



- $100 $-7.2

↳ $100 × 8% × 0.9 = 8 × 0.9 = 7.2

$$VAR_{trader} = VAR_{firm} \times Allocation \times Beta$$

~~$~~ $120 (8% x0.90

$VAR_{t\,days} = SD_{t\,days} \times Z\ score$

$VAR_{portfolio} = SD_{portfolio} \times Z\ score$

↓

$\sqrt{Variance_{portfolio}}$

↓

$(a+b)^2$

$a^2+b^2+2ab\gamma_{ab}$

% portfolio Management $(\sigma_a \underset{\times}{\underline{w_a}})^2 + (\sigma_b \underset{\times}{\underline{w_b}})^2 + 2\sigma_a \underset{\times}{\underline{w_a}} \sigma_b \underset{\times}{\underline{w_b}} \gamma_{ab}$

currency Risk management $\sigma_a^2 + \sigma_b^2 + 2\sigma_a\ \sigma_b\ \gamma_{ab}$

₹, $, €, ¥

		Ri	Wi	RiWi	
ABC	100	10%	0.25	2.5%	₹10
XYZ	300	20%	0.75	15%	₹60
	400		1	17.5%	₹70 lakhs

$R_p = \Sigma R_i \times W_i$

400 × 17.5% = 70

10 + 60 = 70

$Variance_{portfolio}\ (currency) = \sigma_a^2 + \sigma_b^2 + 2\sigma_a \sigma_b \gamma_{ab}$

$SD_{portfolio} = \sqrt{Variance\ portfolio}$

$VAR_p = SD_p \times Z\ score$

$VAR_{p_{10}} = SD_{p_{10}} \times Z\ score$

↓

$\sqrt{Variance_{p_{10}}}$

$$\sigma p_{10}^{2} = \sigma A_{10}^{2} + \sigma x_{10}^{2} + 2\,\sigma A_{10}\,\sigma x_{10}\,\gamma AX$$

$$\sigma A_{10} = \sigma A_{1} \times \sqrt{t} = 200 \times 1\% \times \sqrt{10} = 2 \times 3.162 = 6.324$$

$$\sigma x_{10} = \sigma x_{1} \times \sqrt{t} = 200 \times 1\% \times \sqrt{10} = 2 \times 3.162 = 6.324$$

$$= 6.324^{2} + 6.324^{2} + 2 \times 6.324 \times 6.324 \times 0.3$$

$$= 40 + 40 + 24$$

$$\boxed{\sigma p_{10}^{2} = 104}$$

$$\sigma p_{10} = \sqrt{104}$$

$$\sigma p_{10} = 10.198$$

$$VAR_{10p} = \sigma p_{10} \times \text{Z score}$$

$$= 10.198 \times 2.33$$

$$\boxed{VAR_{10p} = 23.76 \text{ lakhs}}$$

$$= \sigma p_{1} \times \sqrt{t} \times \text{Z score}$$

$$VAR_{ABC_1} = SD_{ABC_1} \times \text{Z score}$$

$$= 2 \times 2.33$$

$$= 4.66$$

$$VAR_{xyz_1} = 4.66$$

$$VAR_{p_1}^{2} = VAR_{A}^{2} + VAR_{x}^{2} + 2\,VAR_{A}\,VAR_{x}\,\gamma_{AX}$$

$$= 4.66^{2} + 4.66^{2} + 2 \times 4.66 \times 4.66 \times 0.3$$

$$= 21.72 + 21.72 + 13.03$$

$$= 56.47$$

$$VAR_{p_1} = \sqrt{56.47} = \underline{7.51}$$

$$VAR_{p\,10} = VAR_{p\,1} \times \sqrt{t}$$

$$= 7.51 \times \sqrt{10}$$

$$= 7.51 \times 3.16$$

$$= 23.75$$

VAR_B

VAR_E

$$\underbrace{\overset{\checkmark}{VAR_p^{\,2}} = \overset{\checkmark}{VAR_E^{\,2}} + VAR_B^{\,2}}_{250 \qquad 250 \qquad 250} + \overset{\checkmark}{2\, VAR_E\, VAR_D}\; r_{EB}$$

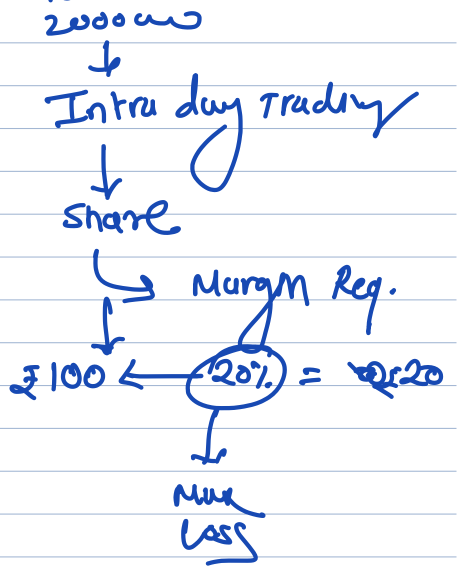
$$r_{EB} \downarrow 0$$

$$\updownarrow$$

?

$$VAR_p^{\,2} = VAR_{CAD}^{\,2} + VAR_{EUR}^{\,2}$$

$$= (\sigma_{CAD} \times Z\,score)^2 + 0.198^2$$



$VAR_4 = SD_4 \times Z \text{ score}$

699000

$= SD_1 \times \sqrt{t} \times Z \text{ score}$

$699000 = \text{Investment} \times 1.5\% \times \sqrt{4} \times 2.33$

$699000 = \text{Investment} \times 6.99$

$$\boxed{\text{Investment} = 10000000}$$

$10000000 \times 1.5\% = 150000$

$VAR_{1\,day} = 150000 \times 2.33$

$= 349500$

↓

$4\,days = 349500 \times \sqrt{4}$

$= 699000$

1000

700000

Measure of Risk

- ① SD – P&L
- ② VAR – Loss
- ③ Beta   -3   -2   -1   0   1   2   3   4   5

  ↓   -2.5   0.35

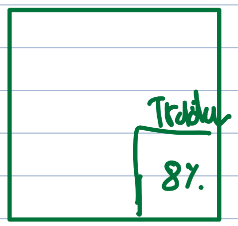
  β

	β	Ri	
Market	1	10% ↑	-10% ↓
TATA Motors	0.9	9% ↑	-9% ↓

+ve direction ↓ same — Extent

	10% ↑	-10% ↓
-0.9	-9% ↓	9% ↑

-ve direction opposite — extent



Firm

₹100 × 8% = 8

$10\% \times 0.9 = 9\%$

₹10   27.2

$= 100 \times 8\% \times 0.9 = 7.2$

↓

$VAR_{Trader} = VAR_F \times Allotted \times Beta$

$$VAR_{P\,10\,days} = SD_{P\,10\,days} \times Z \text{ score}$$

$$\downarrow$$

$$= SD_{P_1} \times \sqrt{t}$$

$$\downarrow$$

$$= \sqrt{Variance_{P_1}}$$

$$Variance_p = \sigma_p^2 =$$

% $\quad \sigma_p^2 = \sigma_A^2 \underline{w_A^2} + \sigma_X^2 \underline{w_X^2} + 2\sigma_A \underline{w_A} \sigma_X \underline{w_X} \gamma_{AX}$

₹/any currency $\quad \sigma_p^2 = \sigma_A^2 + \sigma_X^2 + 2\sigma_A \sigma_X \gamma_{AX}$

		W	R	RiWi	Rp
A	100	0.50	10%	5%	₹10
X	100	0.50	20%	10%	₹20
	200	$\longrightarrow$		15%	₹30

$$R_p = \Sigma R_i w_i$$

(currency) $\quad \sigma_{p_1}^2 = \sigma_A^2 + \sigma_X^2 + 2\sigma_A \sigma_X \gamma_{AX}$

$$= [200 \times 1\%]^2 + [200 \times 1\%]^2 + 2 \times 2 \times 2 \times 0.3$$

$$= 4 + 4 + 2.4$$

$$\sigma_{p_1}^2 = ₹10.4 \text{ lakhs}$$

$$\downarrow$$

$$\sigma_{p_1} = \sqrt{variance} = \sqrt{10.4} = 3.2249$$

$$VAR_{p_{10}} = \sigma_{p_1} \times \sqrt{t} \times Z \text{ score}$$

$$= 3.2249 \times \sqrt{10} \times 2.33$$

$$= 3.2249 \times 3.1623 \times 2.33$$

$$VAR_{P_{10}} = 23.76 \text{ lakhs}$$

portfolio $VAR_{P_{250}} = SDP_{250} \times Z$ score

$1367000 = SDP_{250} \times 1.65$

$SDP_{250} = 828485$

Equity $VAR_{E_{250}} = SDE_{250} \times Z$ score

$1153000 = SDE_{250} \times 1.65$

$SDE_{250} = 698788$

$$SDp^2 = SD_B^2 + SDE^2 + 2 SD_B SDE \underset{\downarrow}{\gamma_{BE}}$$

$$(0.828485)^2 = SD_B^2 + (0.698788) + 0 \quad 0$$

$$0.686387 = SD_B^2 + 0.488305$$

$$SD_B^2 = 1.405652$$

$$SD_B = \sqrt{1.405652}$$

$$SD_B = 1.185602$$ Annual.

$\downarrow$

$$SD_{B_{250}} = SD_{B,1} \times \sqrt{t}$$

$$1185602 = SD_{B,1} \times \sqrt{250}$$

$$SD_B = \frac{1185602}{15.8114}$$

$$SD_{B,1day} = 74984$$

$$VAR_{Bond,1day} = SD_{Bond,1day} \times Z \text{ score}$$

$$= 74984 \times 1.65$$

$= \$123724$

$VAR_{Bond_{250}} = VAR_{Bond_1} \times \sqrt{250}$

$0.734370 = VAR_{Bond_1} \times 15.811$

$VAR_{Bond} = 0.046447$ i.e. \$46447

$VAR_{Bond_{250}} = SD_{Bond_{250}} \times Z\ score$ ✗

$\times 1.65$

$\downarrow$

Variance $SD_p^2 = SD_B^2 + SD_E^2 + 2\, SD_B SD_E \gamma_{BE}$

$VAR_p^2 = VAR_B^2 + VAR_E^2 + 2\, VAR_B VAR_E \underset{0}{\gamma_{BE}}$

$1.367^2 = VAR_B^2 + 1.153^2 + 0$

$VAR_B^2 = 1.8687 - 1.3294 = 0.5393$

$VAR_B = 0.734370$

① ②

$\sigma_p \times Zscore = VAR_p = \sqrt{VAR_p^2}$

$\downarrow$

$VAR_p^2 = VAR_{CAD}^2 + VAR_{EUR}^2 + 2\, \underbrace{VAR_{CAD} VAR_{EUR} \gamma_{CE}}_{0}$

$= VAR_p = \sigma_p \times Z\ \text{Score}$

$= 0.156205 \times 1.65$

$= 0.257738$ i.e. 257738

$4AR_p 2$

$\sigma_p^2 = \sigma_c + \sigma_E^2 + 2\sigma_c\sigma_E \gamma_{CE}$

$= (2 \times 5\%)^2 + (1 \times 12\%)^2 + 0$

$= 0.01 + 0.0144 + 0$

$\sigma_p^2 = 0.0244$

$\sigma_p = 0.156205$

$$VAR_p^2 = VAR_c^2 + VAR_E^2 + 2\,VAR_c\,VAR_E\,\underset{0}{\gamma_{CE}}$$

$$= 0.165^2 + 0.198^2$$

$$VAR_p^2 = 0.066429$$

$$VAR_p = 0.257738$$

$$VAR_c = SD_c \times 2\ \text{score}$$

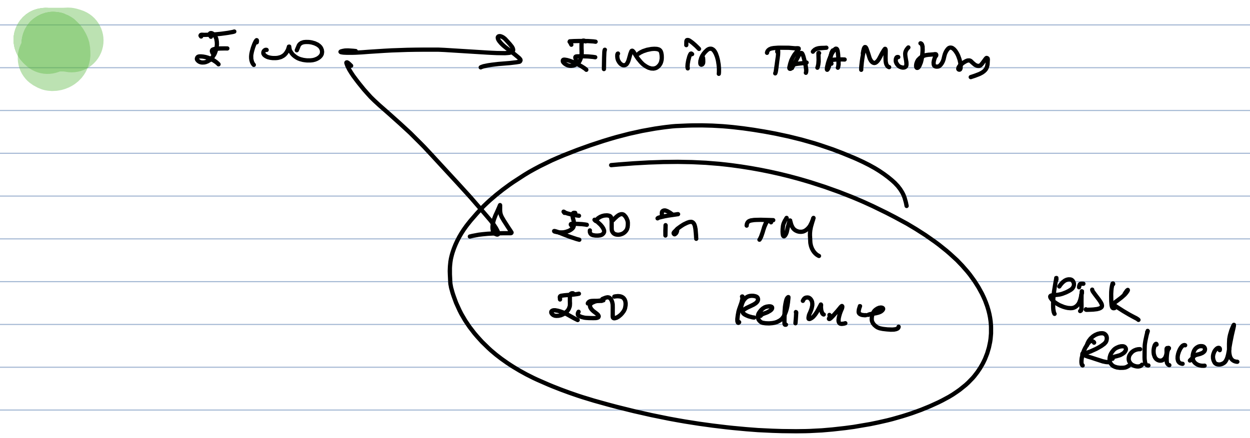
$$= 2 \times 5\% \times 1.65$$

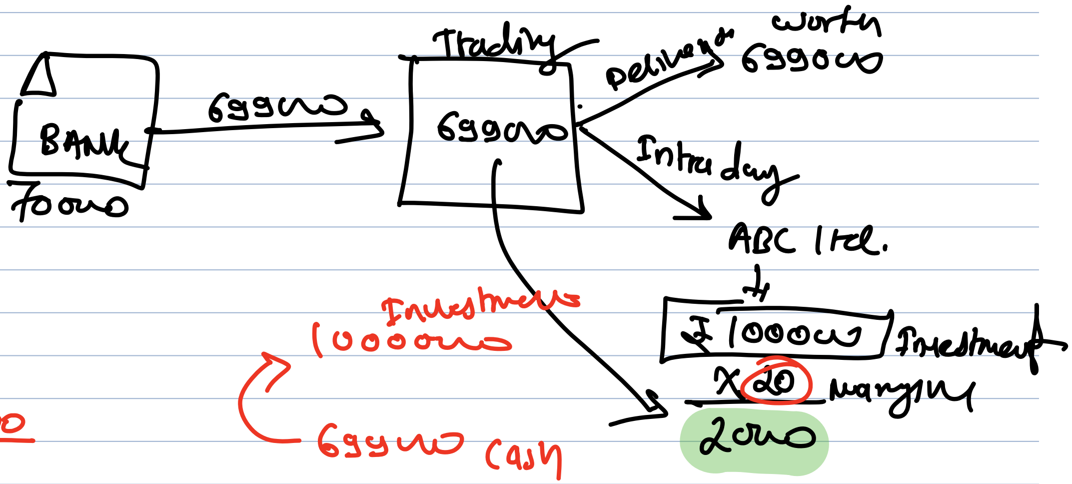
$$= 0.165$$

$$VAR_E = SDE \times Z\ \text{score}$$

$$= 1 \times 12\% \times 1.65$$

$$= 0.198$$





Investments
1000000

699000 cash

6.99% —

699000 / 20%

= 34.95 lakh

1 4
1.40

50

$$= \frac{30 - 15}{50}$$

$$= \frac{15}{50}$$

$$= \boxed{0.3}$$

$$e = 0.33 = \frac{2}{n+1}$$

30 days EMA $= \frac{2}{30+1} = \frac{2}{31} = 0.06$

5 day EMA $= \frac{2}{5+1} = \frac{2}{6} = 0.3333$

Day	1	2	3	4	5
ABC	46	45	41	~~38~~ 35	40

SMA $= \frac{40+38+41+45+46}{5} = \cancel{42}\ 41.4$

EMA $Cp \times e + \overset{SMA}{\text{previous EMA}}(1-e)$

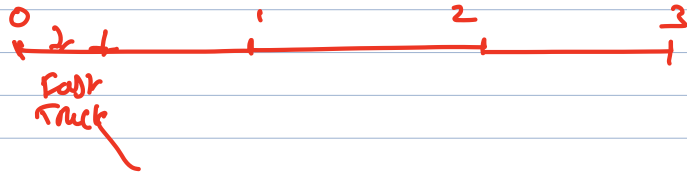
$= 46 \times 0.33 + 41 \times (1-0.33)$

$= 46 \times 0.33 + 41 \times 0.67$

$= 15.18 + 27.47$

$= 42.65$

$$\frac{67}{4} = \boxed{16.75}$$



Drawback → SMA gives equal weight (importance) to recent as well as oldest prices of stock
whereas, recent prices should have more weightage.
↓
EMA

100% = 1

e ✓ 20% 30%

1-e 80% 70%

$$EMA = [CP \times e] + [prev.\ EMA\ (1-e)]$$

$$= \underline{CP \times e} + prev.\ EMA \times 1 - \underline{prev.\ EMA \times e}$$

$$= [CP - prev.\ EMA]\,e + prev.\ EMA$$

Days

0 1 2 3 4 5

ABC 46 44 41 38 40

33% 16.75% 16.75% ---%---

SMA / AMA $= \dfrac{46+44+41+38+40}{5} = 41.80$

Drawback

SMA allots equal weights to all the prices where recent prices should be given more importance.

Solved

$0.33 \quad e = \dfrac{2}{n+1} = \dfrac{2}{5+1} = \dfrac{2}{6} = 33\%$

5day EMA $= [CP \times e] + [\text{previous EMA} \times (1-e)]$

$46 \times 0.33 + [40.75 \times 0.67]$

15.18 27.30

$\dfrac{67}{4} = 16.75$

100% = 1 − 0.33 = 67%

= 42.48

$$EMA = (CP \times e) + [prev.\ EMA \times (1-e)]$$

$$= CP \times e + prev.\ EMA \times 1 - prev.\ EMA \times e$$

$$= prev.\ EMA + e\,[CP - prev.\ EMA]$$

ABC = 70 69 65 60 50

0 1 2 3 4 5

x

72

Efficient market price

Weak Form → 40 = Past prices

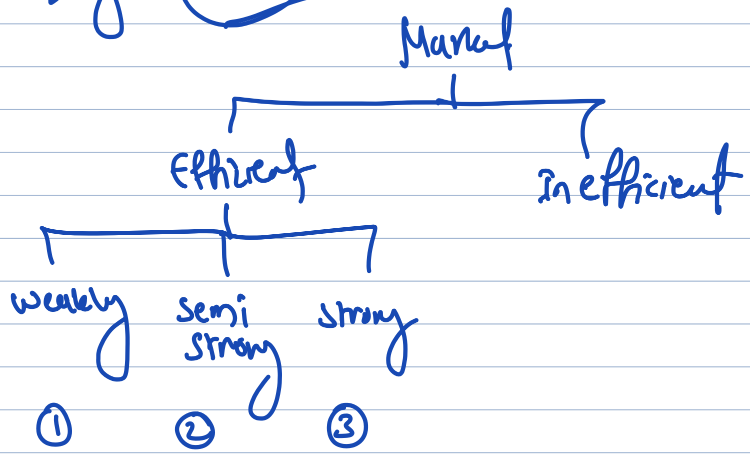
Balance sheet Audit

semi-strong 40 ↓ + Publicly Available

strong

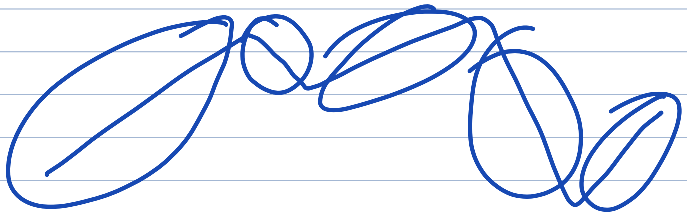
30 32 34 35 38 $\boxed{?}$

Buy Sell?



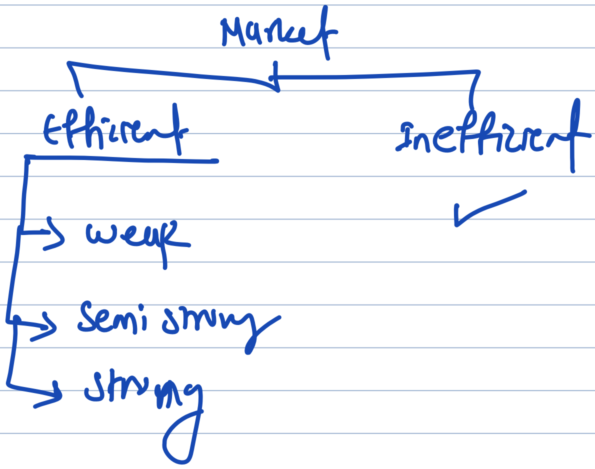
$\boxed{40}$ 39 38 33 32 30

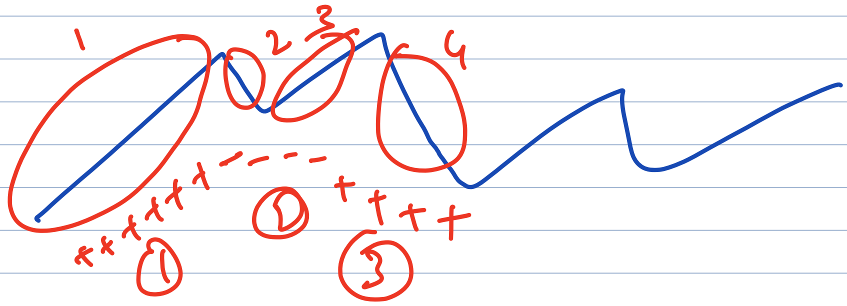
current



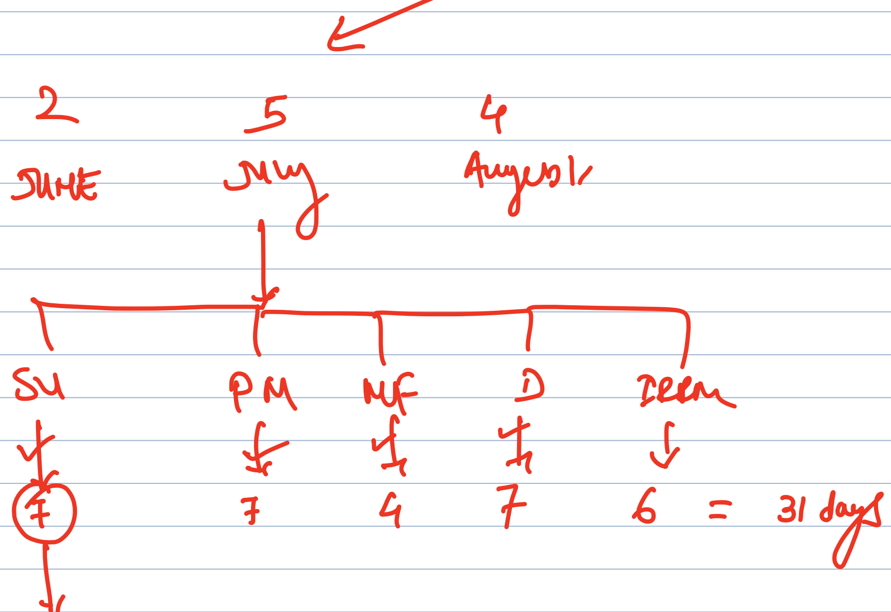
ABC $\boxed{40}$ ✓ 38 37 35 32 30

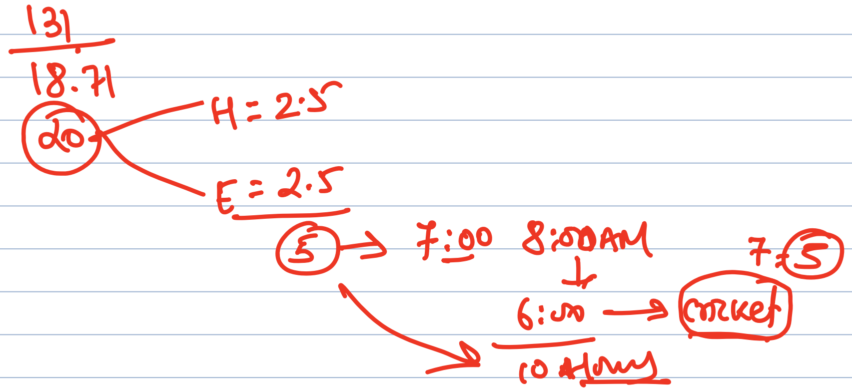
Buying





2m 10days = 14-3=11



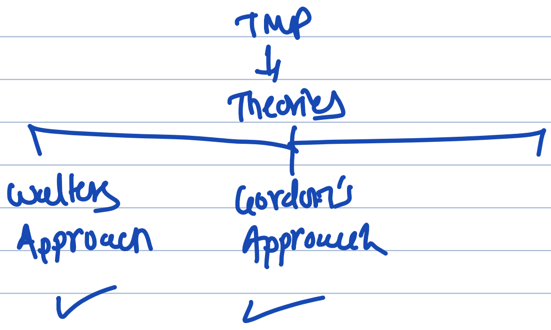


TATA Motors = ₹40 = AMP है

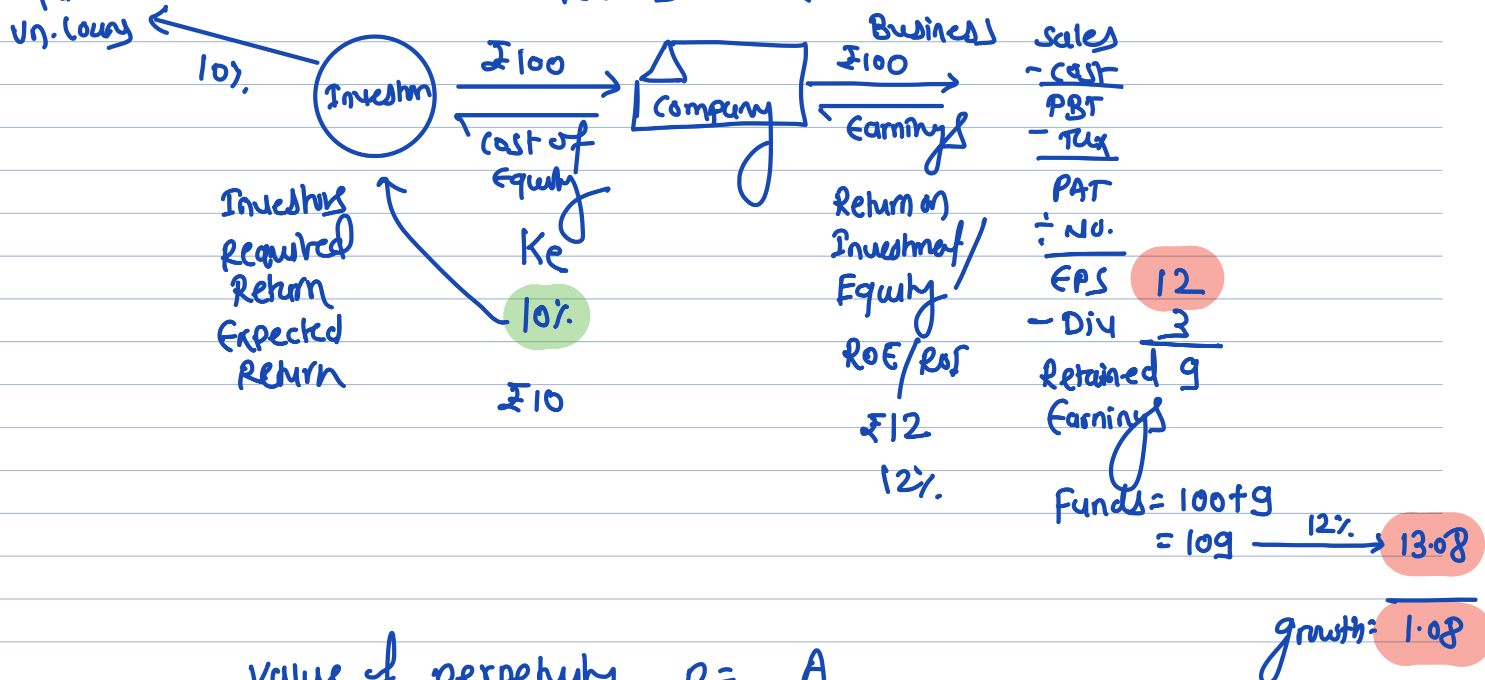
→ = ₹30 = TMP होना चाहीये.

महंगा	Overvalued	AMP (40) > TMP (30)	Sell
सस्ता	Undervalued	AMP (20) < TMP (30)	Buy
बराबर भाव	Correctly valued	AMP (30) = TMP (30)	Hold, Buy

Actual



Walters Model



Value of perpetuity $p = \frac{A}{r}$

$$MP_0 : \frac{EPS}{Ke}$$

$$= \frac{DPS + RPS}{Ke}$$

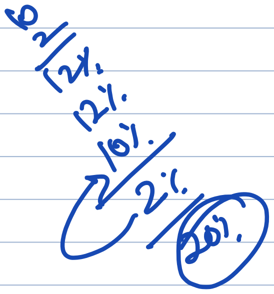
$$= \frac{D + (E-D)}{Ke} = \boxed{\frac{D + \frac{roi}{Ke}(E-D)}{Ke}}$$

$$: \frac{3 + 9}{0.10}$$

$$\frac{\frac{10}{10} \times 3 + \frac{12}{10} \times 9}{0.10}$$

$$= \frac{3 + 1.2 \times 9}{0.10}$$

$$= \frac{3 + 10.80}{0.10}$$



TMP = 138

AMP : 100

Amp (100) < TMP (138)

	Xyz	ABC	
Mp	100	100	
EPS	8	15	
PE	12.50	6.67	Investment
	1	1	Earnings

$$PE = \frac{MP}{EPS} \qquad Ke = \frac{EPS}{MP}$$

$$\frac{1}{PE} = \frac{EPS}{MP} \qquad Ke = \frac{EPS}{MP}$$

$$\boxed{\frac{1}{PE} = Ke}$$

$$P = \frac{A}{8ES}$$

Ke

25%

Dividend Rate	Dividend Yield	Dividend Payout Ratio
↓	↓	↓
Face value (₹10)	Market price (₹100)	Earnings (6)
DPS = 10×25% = 2.5	100×25% = 25	6×25% = 1.5

Tmp = 105

AMP	100	120
	Undervalued	Overvalued

~~Buy~~ Sell

Q3

Net profit 5000000
(−) pref. dividend

$$MP = \frac{D + \frac{r}{Ke}(E-D)}{Ke}$$

$$56 = \frac{D + \frac{15}{12}(8.40-D)}{0.12}$$

$$6.72 = D + 10.50 - 1.25D$$

$$6.72 - 10.50 = -0.25D$$

$$-3.78 = -0.25D$$

$$D = \frac{3.78}{0.25}$$

$$D = 15.12$$

Q4 i] DPR = 15%

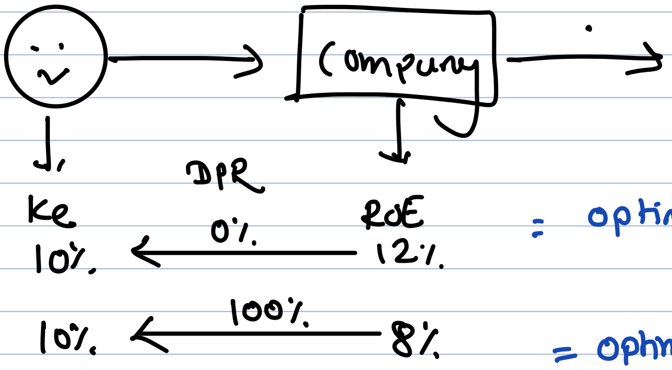
$$MV = \frac{D + \frac{roi}{ke}(E-D)}{ke}$$

$$= \frac{300 \times 15\% + \frac{17}{13}(300-45)}{0.13}$$

$$= \frac{45 + 333.46}{0.13}$$

MV = 2911·24 crores

Optimum Dividend Payout Ratio = 0% ——— 100%
↳ Market price share highest



= optimum DPR = 0%
to
= Optimum DPR = 100%
Market price Highest

$E = 10$
$R = 8\%$
$ke = 10\%$

DPR = 0%. $p = \dfrac{0 + \frac{8}{10}(10-0)}{0.10}$
$= 80$

20%. $= \dfrac{2 + \frac{8}{10}(10-2)}{0.10}$
$= 84$

50%. $= \dfrac{5 + 0.8 \times 5}{0.10}$
$= 90$

Follow

$E = 10$
$R = 12\%$
$ke = 10\%$

DPR = 0%. $p = \dfrac{0 + \frac{12}{10}(10-0)}{0.10}$
$= 120$

20%. $= \dfrac{2 + \frac{12}{10}(10-2)}{0.10}$
$= 116$

50%. $= \dfrac{5 + 1.20 \times 5}{0.10}$
$= 110$

Not followed

$$ke = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(-1.80) \pm \sqrt{(-1.80)^2 - 4 \times 36.25 \times (-0.64)}}{2 \times 36.25}$$

$$= \frac{1.80 \pm \sqrt{3.24 + 92.8}}{72.50}$$

$$= \frac{1.80 \pm 9.80}{}$$

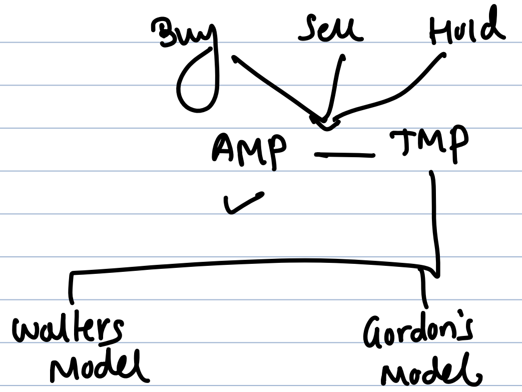
72.50

$$= \frac{1.80 + 9.80}{72.50} \qquad \frac{1.80 - 9.80}{72.50}$$

$ke = 16\%$ or -11.03%

✓

✗

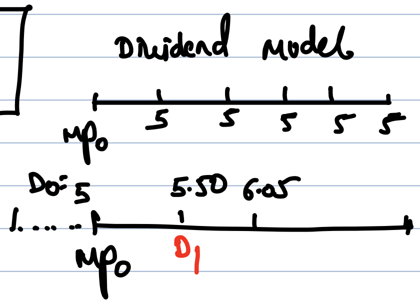


$P = \frac{A}{\gamma}$

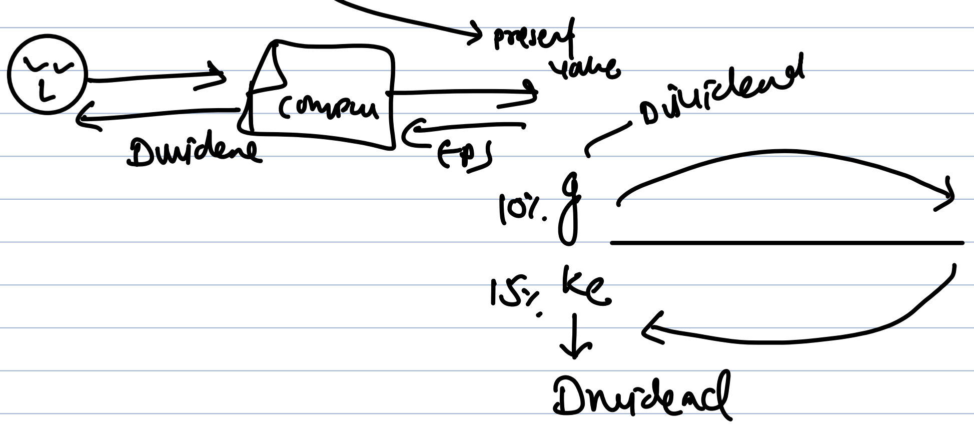
$P_{01} = \frac{A_{1}}{\gamma}$ 2

$$Mp = \frac{D + \frac{\gamma}{Ke}(E - D)}{Ke}$$

$$\boxed{Mp_0 = \frac{D_1}{Ke}}$$



$$Mp_0 = \frac{D_0(1+g)}{Ke-g}$$



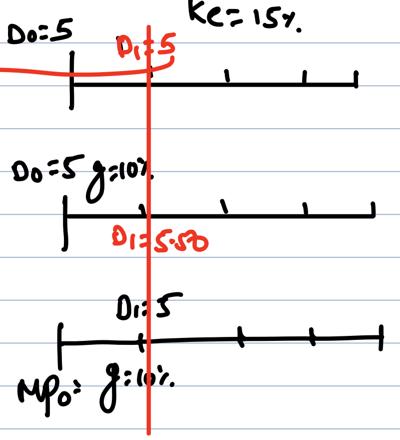
$$MP_0 = \frac{D_1}{Ke}$$

just paid
current
Existing

$$= \frac{D_0(1+g)}{Ke-g}$$

Expected
proposed
to be paid

$$= \frac{D_1}{Ke-g}$$



100 100

X 16%

DR = 25%
RR = 75%
roE = 16%

EPS = 16
−DPS = 4
RE 12
Capital 112 → 16% = 1.92
EPS 17.92

$$\text{growth} : \frac{17.92-16}{16} = \frac{1.92}{16} = 12\%$$

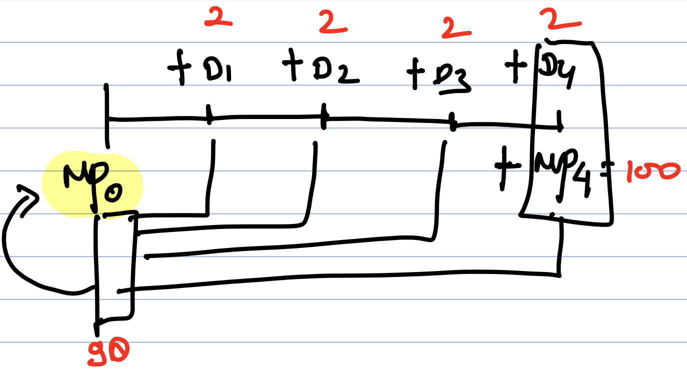
growth = roE × rr
= 0.16 × 75
= 12%

g = br → roE
b → retention Ratio

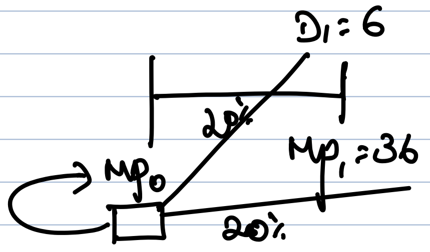
$$MP = \frac{D}{Ke}$$

$$= \frac{D_0(1+g)}{Ke-g}$$

$$= \frac{D_1}{Ke-g}$$



III] Discounted cash flow method



$$PVF = \frac{1}{1+r}$$

$$= \frac{1}{1.20}$$

= 0.83