$$MP = \frac{D_1}{ke - g} \longrightarrow EPS - \underline{RE}\ 80\%$$

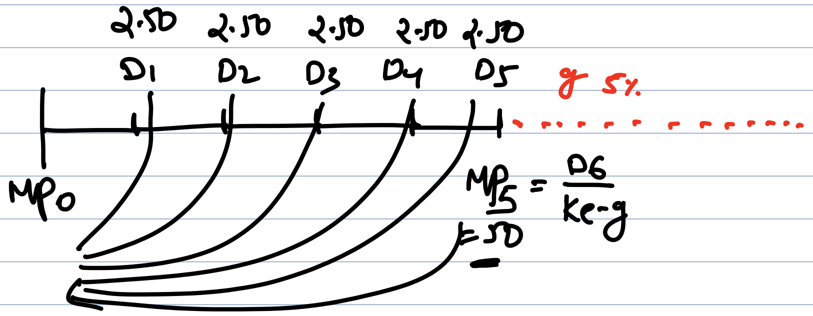
DPR 20%

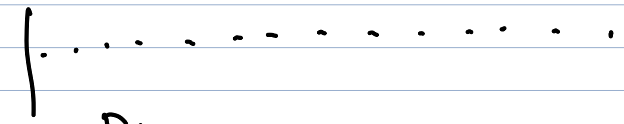
(1-0.80)

or

$$= \frac{EPS(1-b)}{ke - br} = \frac{70(1-0.80)}{}$$

two stage dividend discount





$$MP_0 : \frac{D_1}{ke - g}$$

$$MP_0 = \overline{D_{1-5} \times PVAF} + \overline{MP_5 \times PVF_{5,20\%}}$$

$$= 2.50 \times 2.9906 + \frac{D6}{ke - g} \times 0.4018$$

$$= 7.48 + \frac{D5(1+g)}{ke - g} \times 0.4018$$

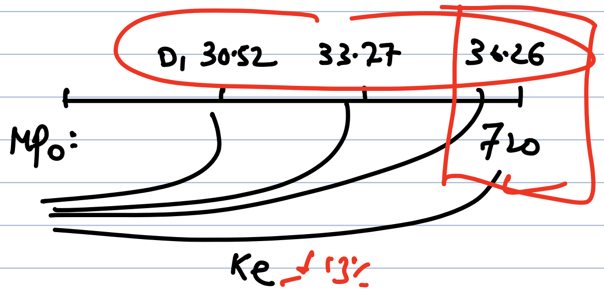
$$= 7.48 + \frac{2.50(1.05)}{0.20 - 0.05} \times 0.4018$$

17.50

$$= 7.48 + 7.03$$

$$= 14.51$$

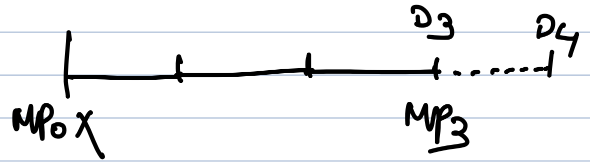
Q18



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

$$= \frac{28(1.09)}{0.13-0.09}$$

$$=$$



$$MP_3 = \frac{D_4}{Ke-g}$$

$$= \frac{D_3(1+g)}{Ke-g}$$

$$= \frac{(1.09)}{0.13-0.09}$$

Do = 28
D1 = 30.52

Q24. proposal 1

$\frac{Assets}{Turnover} = 0.65$

Assets = 30 × 0.65 = 19.5 lakhs
Net profit = 30 × 4% = 1.20 lakhs / PAT

Debt = 8 0.40 2
Equity = 12 0.60 3 2:3
20

E 12
D 8
C 0
20 19.5

19.50 × 60% = 11.70

$ROI = \frac{1.20}{19.50}$ → profit (eq + Debt)
19.50 → Total Assets

$$RoE = \frac{PAT}{Equity\ capital} = \frac{1.20}{12} = 10\%$$

$$g = br = 0.75 \times 10 = 7.5\%$$

$= 6.15\%$

RoI = Eq + Debt

6.15% = 60% 40%

$$ROE = 6.15 \times 60\% = 3.69\%$$

$$g = br = 0.75 \times 3.69 = 2.77\%$$

X

Proposal 2

Sales 30

$\frac{A}{S} = 0.62$

$A = 30 \times 0.62 = 18.60$

Net profit $= 30 \times 5\% = 1.50$

$$RoE = \frac{PAT}{Eq.\ capital} = \frac{1.50}{12+1} = 11.54\%$$

$$DPR = \frac{Dividend}{PAT} = \frac{0.30}{1.50} = 20\%$$

$RR = 1 - 0.20 = 80\%$

$$g = br = 0.80 \times 11.54 = 9.23\%$$

$D:E = 4:1$

13

Debt = 13×4 = 52 lakhs

Equity 13

Total Assets 65 lakhs

$\frac{A}{S} = 0.62$

$$sales = \frac{65}{0.62} = 104.84$$

Net profit = 104.84×5% = 5.24

$$RoE = \frac{\quad}{13} =$$

Q25;

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

$$146 = \frac{3.36}{Ke - 0.075}$$

$$Ke - 0.075 = \frac{3.36}{146}$$

$$Ke = \frac{3.36}{146} + 0.075$$

$$\boxed{Ke = 9.80\%}$$

$$Ke = \frac{D_1}{mp} + g$$

$$\downarrow$$

yield + cy

ii]

$g = br$

$= 0.60 \times 10$

$= 6\%$

EPS = 13.44

DPR = 40%

$D_1 = 5.376$

Existing

$g = br$

$0.75 = b \times 10$

$b = 75\%$

DPR = 25%

$D_1 = 3.36$

EPS = 13.44

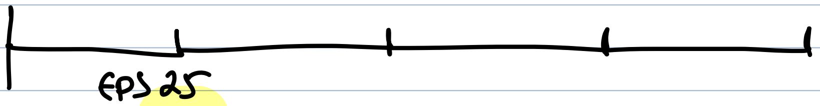
$$MP = \frac{D_1}{Ke - g}$$

$$146 = \frac{5.376}{Ke - 0.06}$$

$$Ke = \frac{5.376}{146} + 0.06$$

$$Ke = 9.68\%$$

Q26



EPS 25

DPS 25

× NO. 10

PAT = Dividend 2,5000,000

-17500000

7500000

1000000

7.5

25000000

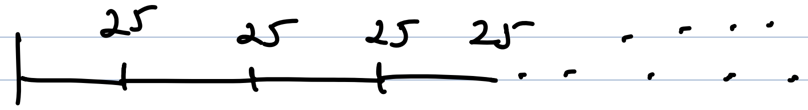
5000000

30000000

1000000

30

①

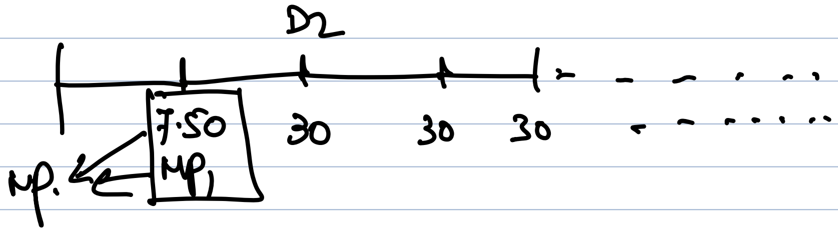


$$MP = \frac{D}{Ke}$$

$$125 = \frac{25}{Ke}$$

$$Ke = 20\%$$

②



$$MP_0 = \left[D_1 + MP_1\right] \times PVF_{20\%,1}$$

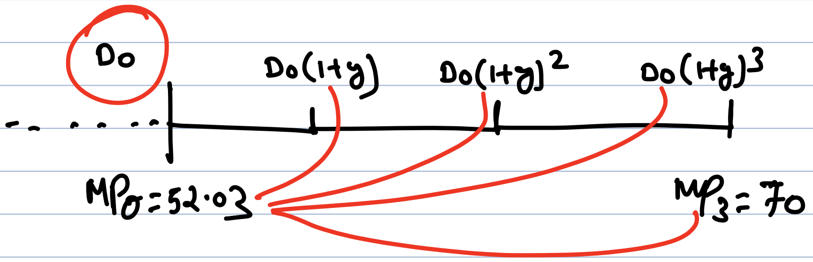
$$= \left[D_1 + \frac{D_2}{Ke}\right] \times PVF_{20\%,1}$$

$$= \left[7.5 + \frac{30}{0.20}\right] \times 0.833 \longrightarrow \frac{1}{1.20} =$$

$$= \left[7.5 + 150\right] \times 0.833$$

$$MP_2 = 131.98$$

Q27



$$MP_0 = D_1 \times PVF_{15\%,1} + D_2 \times PVF_{15\%,12} + D_3 \times PVF_{15\%,3} + MP_3 \times PVF_{15\%,3}$$

$$52.03 = Do(1+g) \times 0.8696 + Do(1+g)^2 \times 0.7561 + Do(1+g)^3 \times 0.6575 + 70 \times 0.6575$$

$$52.03 = Do \times 1.15 \times 0.8696 + Do \times 1.15^2 \times 0.7561 + Do \times 1.15^3 \times 0.6575 + 46.025$$

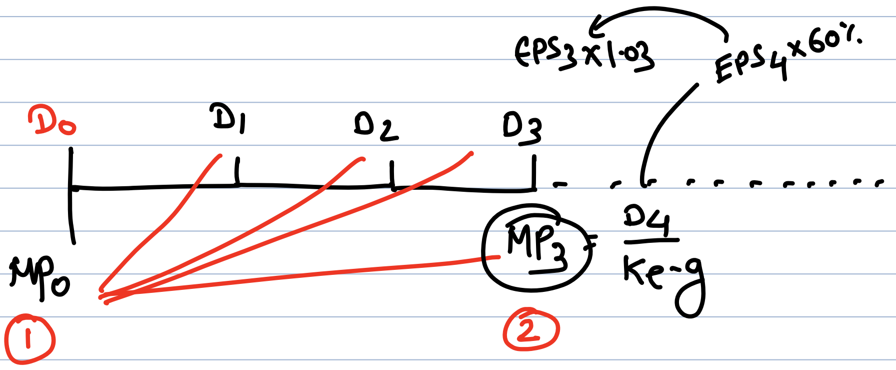
$$52.03 = Do \times 1 + Do \times 1 + Do \times 1 + 46.025$$

$$52.03 = 3\,Do + 46.03$$

$$D_0 = \frac{6}{3}$$

$$D_0 = 2$$

Q2g



$D_0 = 2{\cdot}50$
EPS = 7

$$DPR = \frac{2{\cdot}50}{7{\cdot}00} = 35{\cdot}7143\%$$

$D_0 = 2{\cdot}50$
$D_1 = 2{\cdot}50 \times 1{\cdot}10 = 2{\cdot}75$
$D_2 = 2{\cdot}75 \times 1{\cdot}10 = 3{\cdot}03$
$D_3 = 3{\cdot}025 \times 1{\cdot}10 = 3{\cdot}33$

EPS = 7 ③ ② ① ④
$EPS_1 = 7 \times 1{\cdot}1 = 7{\cdot}70 \times 0{\cdot}3571 = 2{\cdot}75$
$EPS_2 = 7{\cdot}7 \times 1{\cdot}1 =$ ⑤ $8{\cdot}47 \times 0{\cdot}3571 =$ ⑥ $3{\cdot}02$
$EPS_3 = 8{\cdot}47 \times 1{\cdot}1 =$ ⑦ $\boxed{9{\cdot}317} \times 0{\cdot}3571 =$ ⑧ $3{\cdot}33$

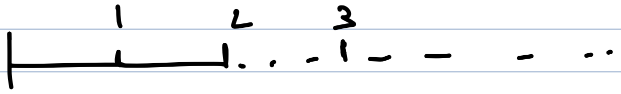
$$MP_3 = \frac{D_4}{Ke - g} = \frac{EPS_4 \times 60\%}{Ke - g} = \frac{EPS_3(1+g) \times 60\%}{Ke - g}$$

$$= \frac{9{\cdot}317 \times 1{\cdot}03 \times 60\%}{0{\cdot}16 - 0{\cdot}03}$$

$$= \frac{5{\cdot}76}{0{\cdot}13}$$

$$MP_3 = ₹44{\cdot}31$$

Q.31

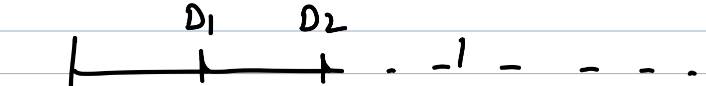


EPS 9.60 × 1.25 = 12 × 1.25 = 15 × 1.10 = 16.50

× 40% × 40% × 50%

DPS 3.84 × 1.25 = 4.8 × 1.25 = 6 8.25

DPR 40%



MP0

$MP_2 = \frac{D_3}{Ke-g}$

$MP_0 : D_1 \times PVF_{15\%,1} + D_2 \times PVF_{15\%,2} + MP_2 \times PVF_{15\%,2}$

$= 4.8 \times \frac{1}{1.15} + 6 \times \frac{1}{(1.15)^2} + \frac{D_3}{Ke-g} \times \frac{1}{(1.15)^2}$

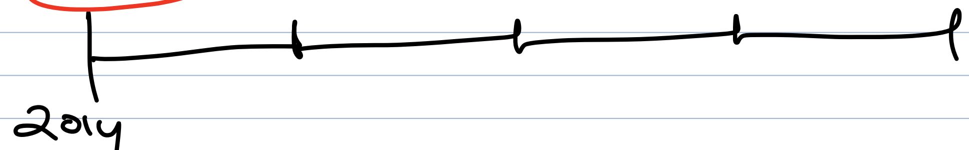
$= 4.8 \times 0.870 + 6 \times 0.756 + \frac{8.25}{0.15-0.10} \times 0.756$

$= 4.18 + 4.54 + 124.74$

$\boxed{P_0 = 133.46}$

EPS = 9.60

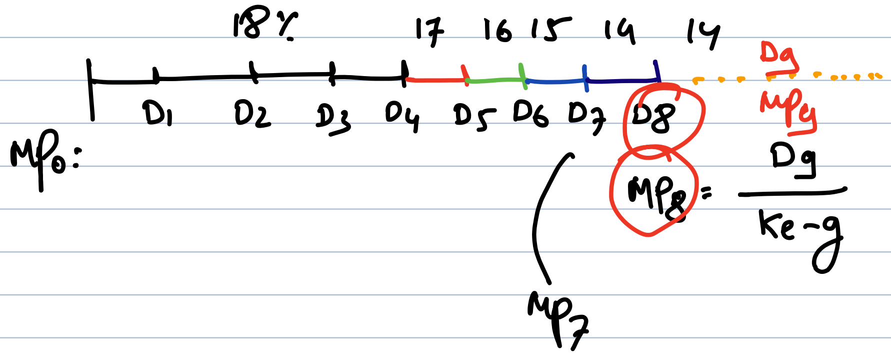
Amp MP = 93.60



Thyp MP0 = 133.46

Actual PE = 93/9.60 = 9.69

Theoretical PE = 133.46/9.60 = 13.90

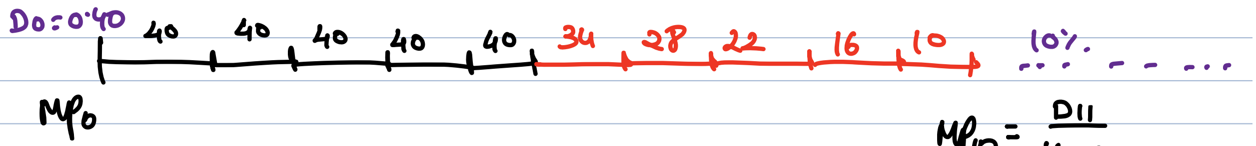


MP0:

$MP_8 = \frac{D_9}{Ke-g}$

yr	D	PVF@18%	PV
1	6		
2	6x1·18 = 7·08		
3	7·08 x1·18 = 8·35		
6	—		
5	—		
6	—		
7	—		
7	TV $\frac{D8}{ke-g}$:		

Q34

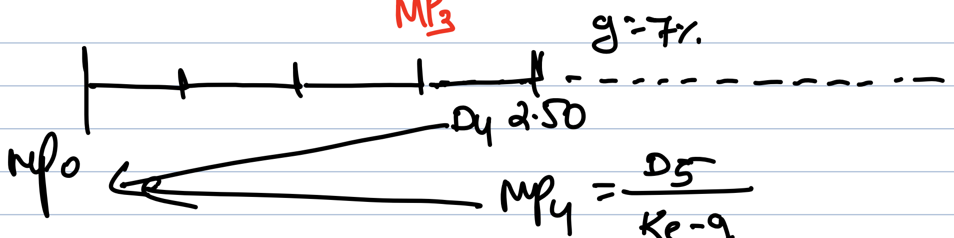


$$MP_{10} = \frac{D_{11}}{Ke-g}$$

year	EPS	DPS	PVF17%	PV
0	4	x0·10 ~~0·40~~		
1	1·40 x 4 = 5·6 ① ② ③ ④	x0·10 = 0·56		
2	= 7·84	x0·10 = 0·78		
3	= 10·98	x0·10 = 1·10		
4	= 15·37	x 0·10 = 1·54		
5	= 21·51	x0·10 = 2·15		
6	21·51x1·34 = 28·82	x0·18 = 5·19		→24·46
7	28·82x1·28 = 36·89	x0·26 = 9·59		
8	36·89x1·22 = 45·01	x 0·34 = 15·30		
9	45·01 x 1·16 = 52·21	x 0·42 = 21·93		
10	52·21 x 1·10 = 57·43	x 0·50 = 28·72		
10	$TV_{10} = \frac{D_{11}}{Ke-g} = \frac{D_{10}(1+g)}{Ke-g}$	= 451·31		→94·29

$$= \frac{28·72(1·10)}{0·17-0·10}$$

$= 451·31$



$$MP_4 = \frac{D_5}{Ke-g}$$

$$MP_0 = \left[D_4 + MP_4 \right] \times \frac{1}{(1+ke)^4} \text{ or } PVF_{8\%,14th}$$

$$= \left[2.50 + \frac{2.50(1.07)}{0.08-0.07} \right] \times 0.735$$

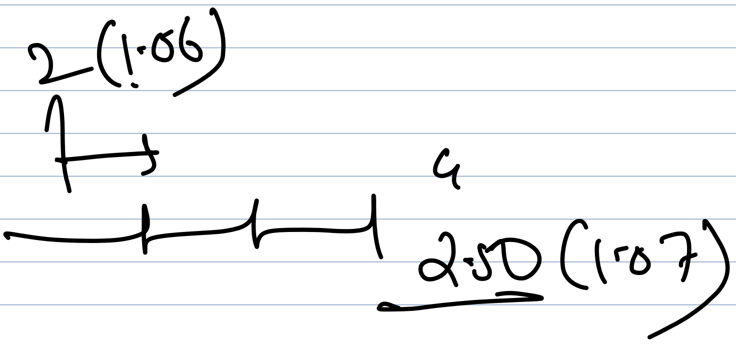
$$\boxed{MP_0 = 198.45}$$

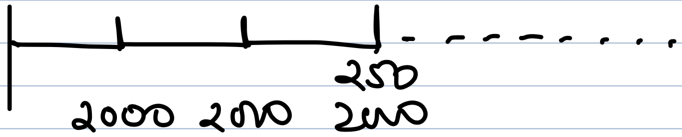
$$MP_0 = MP_3 \times PVF_{8\%,3}$$

$$= \frac{D_4}{Ke-g} \times PVF_{8\%,3}$$

$$= \frac{2.50}{0.08-0.07} \times 0.794$$

$$\boxed{MP_0 = 198.50}$$





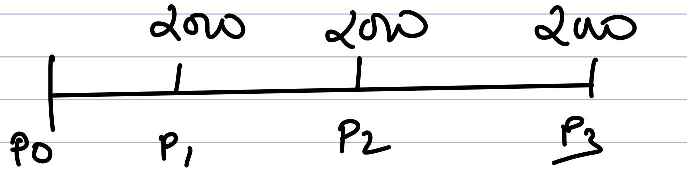
2000 2000 2000

$\frac{P_1}{No.}$ $\frac{P_2}{No.}$ $\frac{P_3}{No.} = \frac{D_4}{Ke-g} = \frac{2.50}{0.08-0.07} = 250$

$MP_0 = MP_3 \times PVF_{8\%,3}$

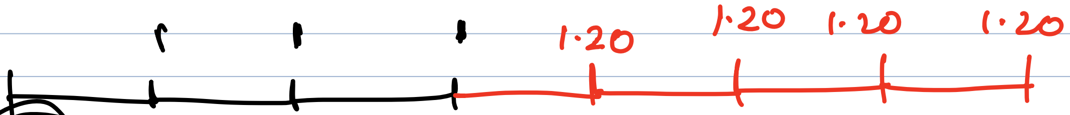
$MP_1 = MP_3 \times PVF_{8\%,12} = 250 \times 0.857 = 214.25$

$MP_2 = MP_3 \times PVF_{8,1\%} = 250 \times 0.926 = 231.50$



$\frac{214.25}{9.33}$	$\frac{231.50}{8.64}$	$\frac{250}{8}$
10	i.e. 9	

$\frac{1}{5} = 0.20$



Amp 500

R4	1.05	$\frac{100}{100}$	$\frac{100}{100}$	$\frac{100}{150}$	$\frac{100}{120}$	$\frac{100}{120}$	$\frac{100}{120}$	$\frac{100}{120}$
DPS	×20%	₹20	20	20	24	24	24	24

= x

PV of CIF

565

900

1080

− 5%

1026

$\frac{x}{\text{Max price of share}} \times 1.05 = \underset{\text{Max cash outflow}}{1.05x} = \text{Max Cash Inflow} = \text{PV of Dividend} + \text{PV of 1026}$

~~563.68~~ 563.68

1.05x = 563.68

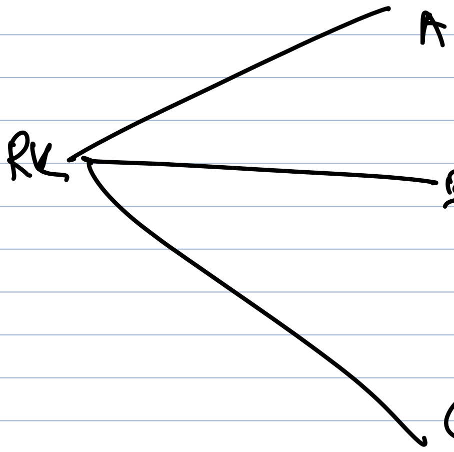
x =

536.84 × 1.05 = 563.68 ✓ ₹ 563.68

→ 500

537 563 ↗ ×

crore

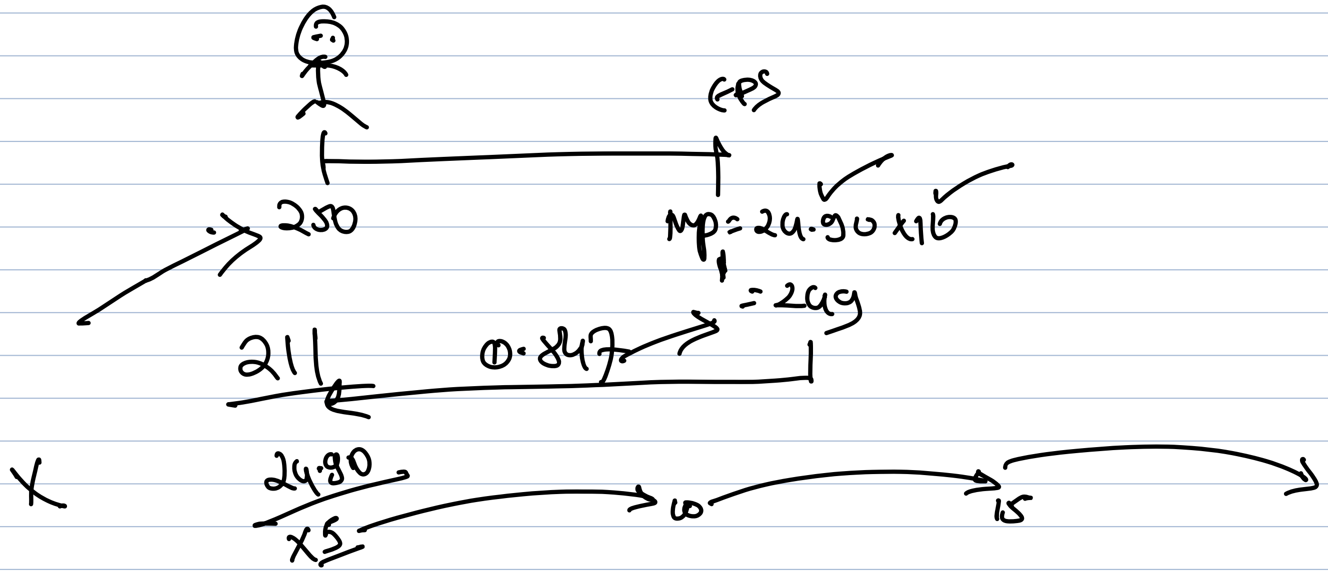


A 50 × 10% = 5 × 5% = 0.25

B 20 × 30% = 6 × 8% = 0.48

C 85 × 2% = 0.17 × 10% = 0.017

PAT	7470000
No.	300000
EPS	24.90
MP	250
PE	10.04



EPS 24.90 28.64 32.93 37.87 15%

DPS 30%

2 D_3 11.36

$$MP_3 = \frac{D_4}{ke-g}$$

$$= \frac{11.36(1.15)}{0.18-0.15}$$

$$= 435.47$$

446.83

MP. 272.12 ← 0.609 $PUF_{18\%,3}$ ← 446.83

① $MP_0 = [D_3 + MP_3] \times PUF_{18\%,3}$

② $MP_0 = MP_2 \times PUF_{18\%,2}$

$$= \frac{D_3}{ke-g} \times PUF_{18\%\times 2}$$

$$= \frac{11.36}{0.18-0.15} \times 0.718$$

$= 378.66 \times 0.718$

$= \underline{271.88}$

H MODEL

Normal growth Rate / stable / perpetual

$$MP_0 = \frac{D_0(1+g_n)}{K_e - g_n} + \frac{D_0 \times H_1 \times [g_c - g_n]}{K_e - g_n}$$

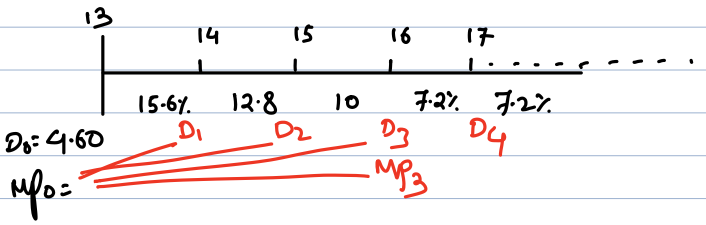
current growth Rate / High growth Rate

Half of High growth period

$$= \frac{D_0(1+g_n) + D_0 H_1 (g_c - g_n)}{K_e - g_n}$$

$$= \frac{D_0 + D_0 g_n + D_0 H_1 g_c - D_0 H_1 g_n}{K_e - g_n}$$

$$= D_0 [1 + g_n + H_1 g_c - H_1 g_n]$$



$$MPo = \frac{Do(1+g_n) + Do\,H_1(g_c-g_n)}{ke-g_n}$$

$$= \frac{4.60(1.072) + 4.60 \times 2(0.156-0.072)}{0.10-0.072}$$

$$= \frac{4.93 + 0.77}{0.028}$$

$$MPo = 203.57$$

Year	Dividend
1	4.6x1.156 = 5.32
2	5.32 x 1.128 = 6.00
3	6.00 x 1.10 = 6.60
4	6.60 x 1.072 = 7.08

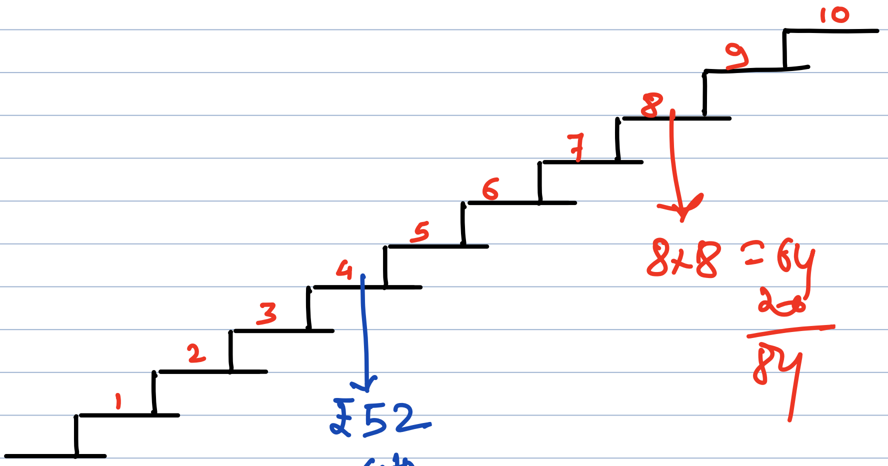
$$MP_3 = \frac{D_4}{Ke-g} = \frac{7.08}{0.10-0.072} = 252.86$$

Year	CF	PvF10%	PV
1	5.32	0.909	4.84
2	6.00	0.826	4.96
3	6.60	0.751	4.96
3	252.86	0.751	189.90
			204.66

IRR

INTERPOLATION

₹100
10



8x8 = 64
20
84

₹52
4th

Amount ₹20
Steps 0

0 20
4 10 100
4 x 10 ÷ 80

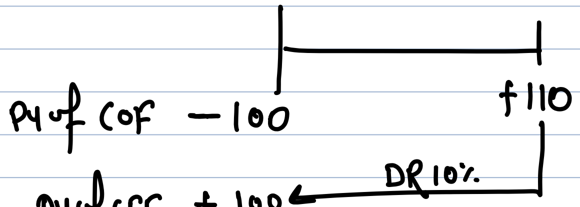
Add'l step 4x
value per step 8

$20 + \frac{80}{10} \times 4$

$20 + 8 \times 4$

$20 + 32$

$= 52$

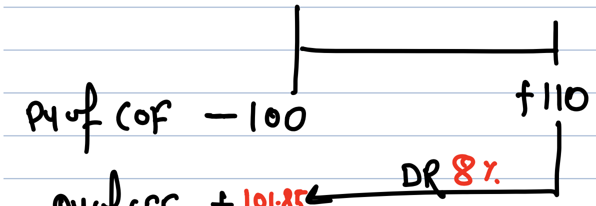


PV of COF −100 +110

PV of CIF +100 ← DR 10%

$\frac{110}{1.1}$

NPV 0

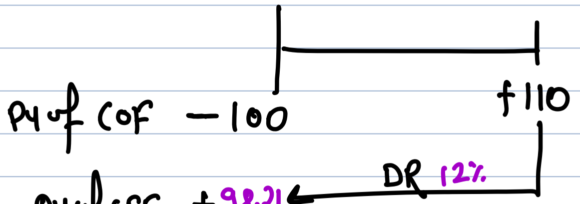


PV of COF −100 +110

PV of CIF +101.85 ← DR 8%

$\frac{110}{1.08}$

NPV 1.85



PV of COF −100 +110

PV of CIF +98.21 ← DR 12%

$\frac{110}{1.12}$

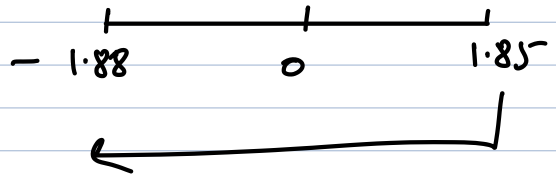
NPV −1.88

$\frac{1}{1.10} = 0.909$ NPV ↑ DR ↓

NPV ↓ DR ↑

$\frac{1}{1.08} = 0.926$

$\frac{1}{1.05} = 0.952$



$$\begin{array}{ccc} DR & NPV & \\ 8\% & 1.85 & 0 \\ 12\% & -1.88 & \\ \hline 4 \div & 3.73 \times & 1.85 \end{array}$$

$= 8 + \frac{4}{3.73} \times 1.85$

$= 8 + 1.98$

$= 9.98$ i.e. 10%

Q39

1] $MP = \frac{D_0(1+g)}{ke-g}$

$20 = \frac{1(1.12)}{ke - 0.12}$

$ke = \frac{1.12}{20} + 0.12$

$\boxed{ke = 17.60\%}$

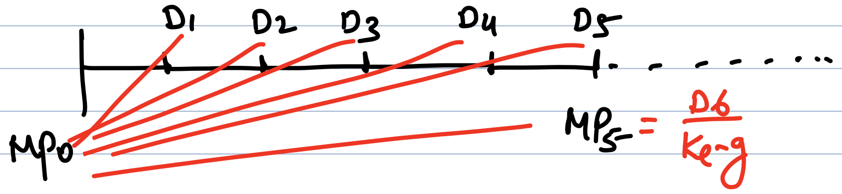
IRR, NPV = 0 ✓

✓

PV of CIF = PV of COF

✓ ✓

ii]



yr	CF	PVF@20%	PV
1	1x1.20= 1.2	0.833	'
2	1.2x1.2= 1.44	0.694	'
3	1.44x1.20= 1.73	0.579	'
4	2.07	0.482	'
5	2.49	0.402	/
5	MP5 27.39	0.402	11.02
			16.02
			20.00

$= \frac{D6}{Ke-g} = \frac{2.49 \times 1.10}{0.20-0.10}$

yr	CF	PVF@17%	PV
1	1.20	0.855	1.03
2	1.44	0.731	1.05
3	1.73	0.624	1.08
4	2.07	0.534	1.11
5	2.49	0.456	1.14
5	39.13	0.456	17.84
			23.25

$\frac{D6}{ke-g} = \frac{2.49 \times 1.10}{0.17-0.10}$

17	23.25	
20	16.02	20.00
3	7.23	3.25

$= 17 + \frac{3}{7.23} \times 3.25$

$= 17 + 1.35$

IRR = 18.35%

f

yr	CF	PVF-18.35	PV
1	1.20	0.845	1.01
2	1.44	0.714	1.03
3	1.73	0.603	1.04
4	2.07	0.510	1.06
5	2.49	0.431	1.07
5	32.80	0.431	14.14
			19.35

$MP_5 = \frac{D6}{Ke-6}$

$= \frac{2.49(1.10)}{0.1835-0.10}$

FCFE

Free

Equity

Balance sheet

Equity	Dividend	
pref. shares	~~Dividend~~	FA ✓
Debt	~~Int~~ / principal	
Loan	~~Int~~ / principal	
CL		CA

CA - CL = WC ✓

FCFE = - principal - ↑ΔWC - CAPEX + Dep

FA
TO BANK deduct

BANK Add
TO FA

BANK 3
STF 3

Profit & Loss

1000 Sales
740 - operating cost (cash)
260 operating profit EBITDA
50 - Depreciation / Amortisation (Non cash)
210 EBIT operating profit D+L+G+P+E
60 ① - Interest [Debt + Loan]
150 EBT E+P+G
75 ② - Tax
75 EAT_{P+E} E + P
0 ③ - pref. dividend
75 EAT_{Equity} Equity
④ - Eq. dividend
Retained Earnings

→ EAT_E
+ Dep

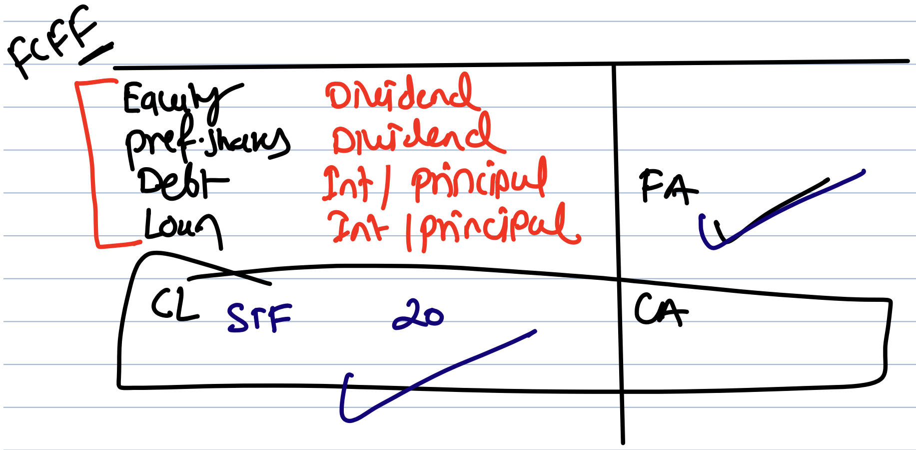
- CAPEX	+ Sale FA
- ↑ΔWC	+ ↓ΔWC
- principal Repay	+ New Long Term funds Raise

FCFE

Non cash	CA =	10	10
Non cash	CL =	4 → 3 =	7
	WC	6	3

Direct	CA ↑	WC ↑	cash outflow	deduct
indirect	CL ↓	WC ↑	cash outflow	deduct
	CA ↓	WC ↓	cash inflow	Add
	CL ↑	WC ↓	cash inflow	Add

FCFF



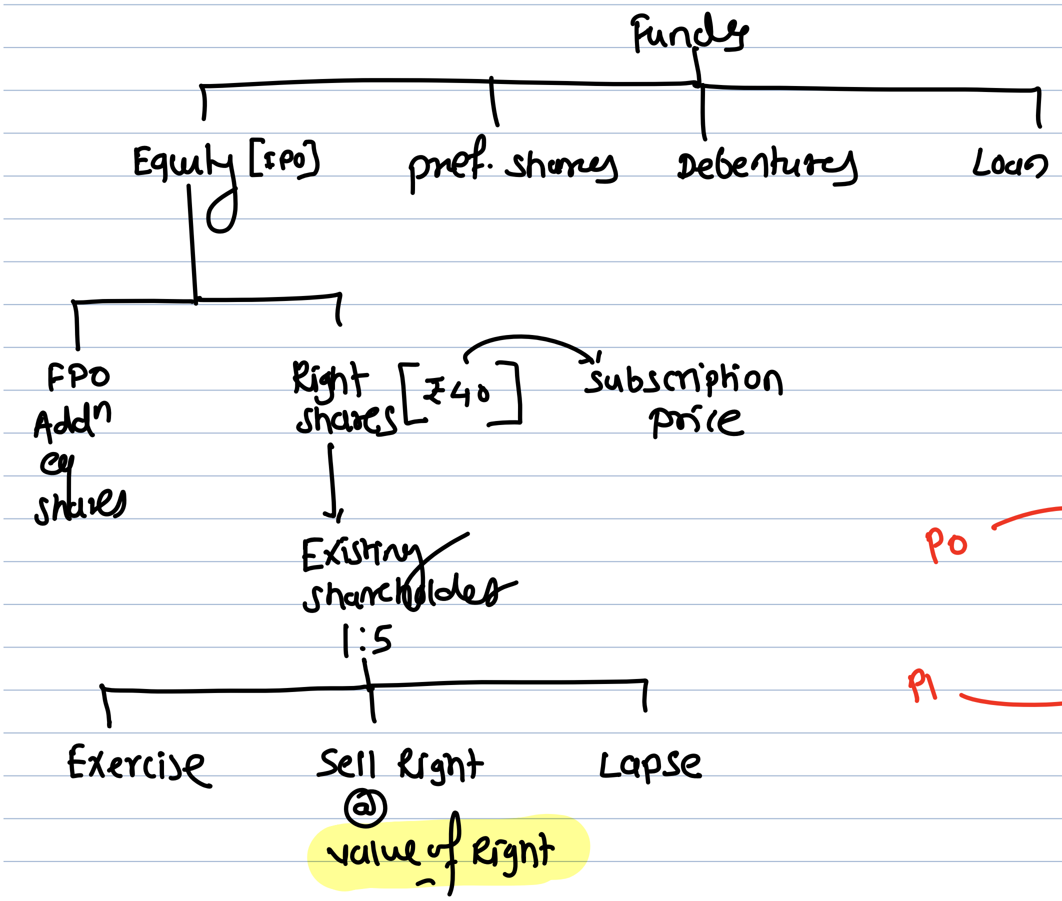
$$FCFF = EBIT(1-tax) + \underline{Depreciation} - \underline{CAPEX} - \underline{\uparrow \Delta WC} + \overset{SFF}{20}$$

$$= (EBITDA - Dep)(1-tax) + Dep$$

$$= EBITDA(1-tax) - \cancel{Dep} + Dep \times tax + \cancel{Dep}$$

$$= EBITDA(1-tax) + Dep \times tax\ rate - CAPEX - \Delta WC - \cdot\cdot$$

$$= FCFE$$



P0

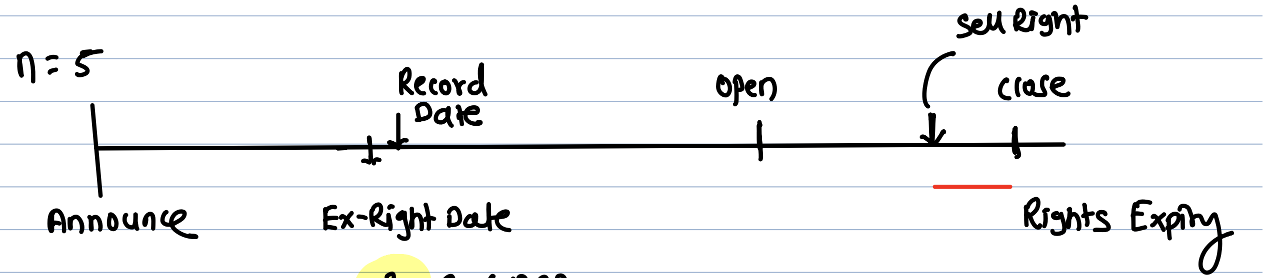
P1

Per share

$5 \times 50 = 250$

$5 \times 48.33 = 241.65$

1.67 $\quad 8.33$



share price $P_0 = 50$? $P_1 = 48.33$

Cum Right — Rights on | Ex-Right

Shares	n	5	5
Right	n_1	1	0

$$P_1 \quad MP = \frac{\text{Market value}}{\text{No.}} \overset{①}{=} \frac{n \times P_0 + n_1 \times S}{n + n_1} \checkmark$$

$$= \frac{5 \times 50 + 1 \times 40}{6}$$

$$= \frac{250 + 40}{6}$$

$$= 48.33$$

$$\frac{10}{6} = 1.67$$

$$\text{Value of Right} \overset{②}{=} P_0 - P_1 = 50 - 48.33 = 1.67 \times 5$$

$$③ = \frac{n_1 [P_0 - S]}{n + n_1} = \frac{1[50-40]}{5+1} = 1.67 \times 5$$

$$④ = \frac{n_1 (P_1 - S)}{n} = \frac{48.33 - 40}{5} = 1.67 \times 5$$

Qu8

$$P_1 = \frac{nP_0 + n_1 S}{n + n_1}$$

1:5

$$36 = \frac{1 \times 40 + n_1 \times 32}{1 + n_1}$$

0.2:1

$$36 + 36n_1 = 40 + 32n_1$$

1:5

$$4n_1 = 4$$

$$n_1 = 1$$

1:1

1:2			1:4		
pre 2x 13		= 26	4x 13 =		52
post 2x 10 =	30		5x12	60	
1 x 4	-4	26	1 x 8	-8	52
		0			0

Right

Exercise Sell waste

No change No change loss

✗ ✓ ✓

Po = 72 P_1 = 67.20 ✓   S=48   V=19.20

pre- 100 x 72 = 7200 ✓

post 100x 67.20 = 6720

sell 25x 19.20 480

7200 ✓

Po = 24

P_1 = 22.40

S = 16

$\boxed{V = 6.40}$

pre 1000 x 24 24000

post 1000 x 22.40 22400

loss (1600)

shares		rights
1000 ÷	4 =	250
1.60	1	6.40
1600		1600

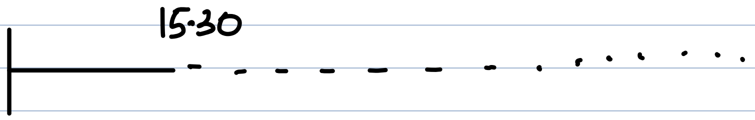
Q53

Po	50	48.33 TMP 50 AMP	60
S	40	40	40
V	$\frac{10}{6}$ = 1.67	$\frac{10}{5}$ = 2	$\frac{20}{5}$ 4

1] Buy stock $\frac{1000}{50} = 20 \times 60 = 1200 - 1000 = \overset{\text{profit}}{\frac{200}{1000}} = 20\%$

2] Buy Rights $\frac{1000}{2} = 500 \times 4 = 2000 - 1000 = \frac{1000}{1000} = 100\%$

Q54



PV of COF −150

PV of CIF 170 $= P = \frac{CF_1}{Ke-g} = \frac{15.30}{0.13-0.04} = 170$

NPV 20

Po = 22.60 cum dividend | ex dividend 22.60 − 1.40 = 21.20
g = 6%
N = 50 crore
FV = 10
Do = 1.40

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

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

$$Ke = \frac{Do(1+g)}{MP} + g$$

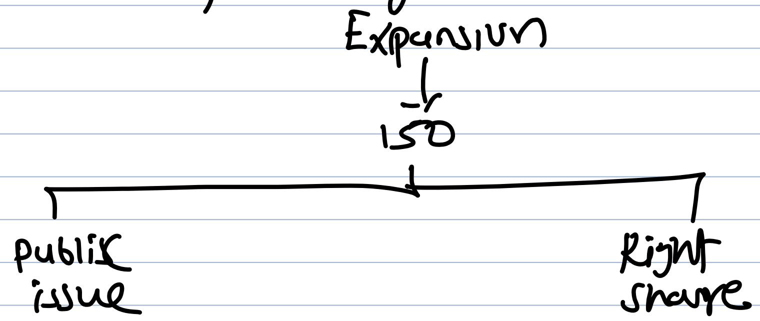
$$= \frac{1.40(1.06)}{21.20} + 0.06$$

$$= 13\%$$

pre expansion value of company $= n \times P_0 = 50 \times 21.20 = 1060$ crore

Addition in value 170

post expansion value of company 1230 crore



right

ii]

$n = 50$ $P_0 = 21.20$

$n_1 = 10$ $[50 \times 1/5]$ $S = 15$

60

$$P_1 = \frac{nP_0 + n_1 S}{n+n_1}$$

$$= \frac{50 \times 21.20 + 10 \times 15}{60}$$

$$= \frac{1060 + 150}{60}$$

$$P_1 = 20.16$$

✗

$$P_1 = \frac{nP_0 + n_1 S + NPV}{n+n_1}$$

$$= \frac{1060 + 150 + 20}{60}$$

$$= \frac{1230}{60}$$

$$= 20.50$$

$$21.20 \downarrow 20.50$$

iii public issue $= n_1 \times IP = 150$

$$= n_1 \times P_1 = 150$$

$$= n_1 \left[\frac{\text{Market value}}{\text{No. of shares}}\right] = 150$$

$$= n_1 \left[\frac{1230}{50 + n_1}\right] = 150$$

$$= \quad 1230n_1 = 7500 + 150n_1$$

$$1080n_1 = 7500$$

$$n_1 = 6.94444 \text{ crore}$$

$$\text{Issue price} = \frac{150}{6.944} = 21.60$$

$$\begin{aligned} P_0 &= 50 \times 21.20 = 1060 \\ \text{Existing} \quad n \times P_1 &= 50 \times 21.60 = 1080 \\ \text{New} \quad n_1 \times P_1 &= 6.944 \times 21.60 = \underline{150} \\ & \qquad\qquad\qquad\quad \underline{1230} \end{aligned}$$

20 crore

14] gain to existing shareholders

Right Issue

Before right issue	50x21.20		1060
After right issue	60x20.50 = 1230		
- subscription value		150	1080
gain			20

Public Issue

Before	50 x 21.20	1060
After	50 x 21.60	1080
		20

PREFERENCE VALUATION

Equity valuation	preference shares valuation
D_1	PD_1
ke	kp
g	g
MP_3	RV_3

RV_3:

PAR ↓ 1000

premium 10% 1100

Discount 10% 900

pref. shares

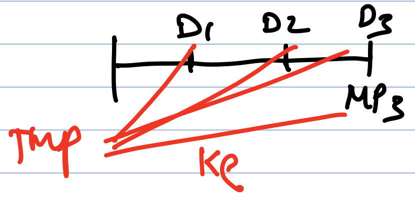
FV 1000

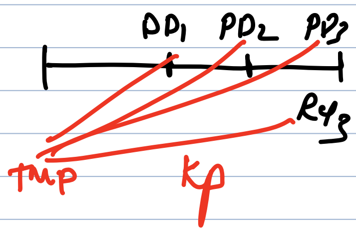
PD 10%

t 3 years

MP. 1150

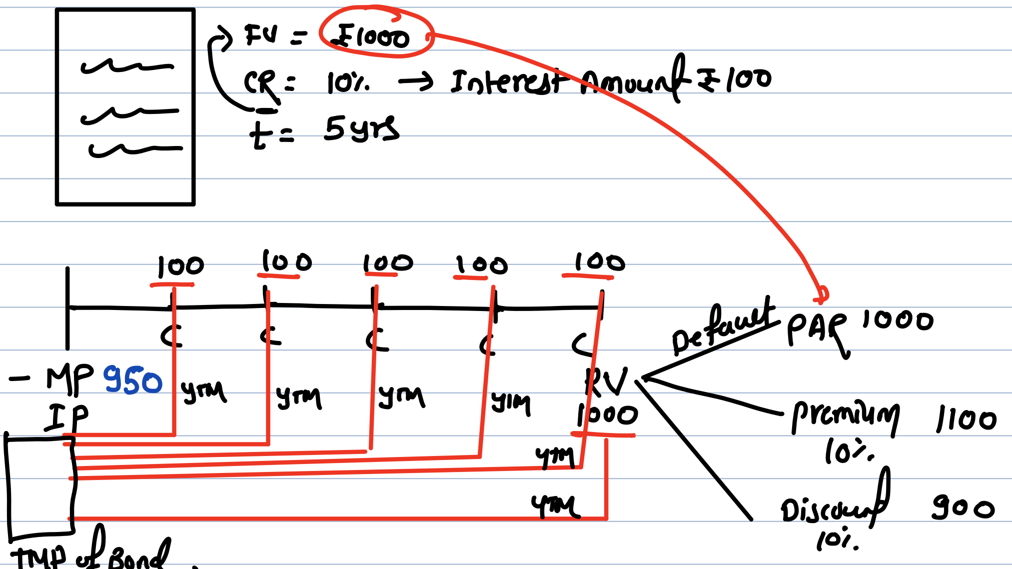
perpetual	$\frac{D_0(1+g)}{ke-g}$	$\frac{PD_0(1+g)}{kp-g}$
limited time 3 year	$D_1 \times PVF_1$ $+ D_2 \times PVF_2$ $+ D_3 \times PVF_3$ $+ MP_3 \times PVF_3$	$PD_1 \times PVF_1$ $PD_2 \times PVF_2$ $PD_3 \times PVF_3$ $RV_3 \times PVF_3$





BOND VALUATION

<u>structure</u>



TMP of Bond
Fair / value
Intrinsic value
MP of Bond

Equity	MP	DE	Ke
pref.	MP	DP	Kp
Bond	MP	Interest /(coupon)	yield = Return

AMP = TMP , correctly valued - Hold
AMP < TMP , undervalued − Buy
AMP > TMP , overvalued − Sell

Perpetual

Redeemable

$MP_{BOND} = \underline{Int \times PVAF_{YTM}} + \underline{RV \times PVF_{YTM}}$

IRR

↓

Trial & ERROR

① Rate Assume

② Rate

↓

Interpolate

↓

ytm

$$MP \rightarrow P = \frac{A}{r}, \quad MP_E \rightarrow P$$

A → Interest

A → Equity dividend

r → YTM

r → Ke

$$Mp = \frac{Interest}{Current\ yield} = FV \times CR$$

$$1100 = \frac{1000 \times 10\%}{CY}$$

$$CY = \frac{100}{1100} = \frac{Int}{MP}$$

$$= 9.09\%$$

$$\text{yield [YTM] p.a.} = \frac{Return}{Investment}$$

$$= \frac{Coupon + capital\ gain}{Investment}$$

$$YTM = \frac{C + \frac{RV-MP}{n}}{Avg.\ Investment}$$

$$\boxed{CY = \frac{Interest}{MP}}$$

$$\boxed{YTM = \frac{C + \frac{RV-MP}{n}}{\frac{RV+MP}{2}}}$$

Avg Method

Q60

100 ———— 110 $\quad \frac{10}{100} = 10\%$

90 ———— 110 $\quad \frac{20}{90} = 22.22\%$

MP

90 → 100 ↑

↓

YTM

22.22% → 10% ↓

↑

$$MP \propto \frac{1}{YTM}$$

Q63

i] $CA = P(1+r)^t$

$\downarrow \quad \downarrow$

$RV = MP(1+ym)^t$

$10000 = mp\,(1.075)^{10}$

$10000 = mp \times 2.061$

$MP = 4852$

ii]

98500 81 days RV 100000

yield

$\text{yield} = \frac{\text{Return}}{\text{Investment}} = \frac{100000-98500}{98500} = 1.5228\%$ for 81 days

$\therefore$ yield p.a. $= \frac{1.5228}{81} \times 365 = 6.86\%$ p.a.

Q64

i) $y = \frac{Int}{MP}$

$= \frac{10\% \times 100}{110}$

$= \frac{10}{110}$

$= 9.09\%$

$+ \ 1.00$

10.09%

$y = \frac{Int}{MP}$

$0.1009 = \frac{10}{MP}$

$\boxed{MP = 99.11}$

ii)

Q65

Rate , $MP = 1025.86$

$\boxed{14\%}$ $MP = 1033.95 \rightarrow$

15% $MP = 1000$ 1025.86

1% $\div$ 33.95 $\times$ 8.09

$= 14 + \frac{1}{33.95} \times 8.09$

$YTM = 14.24\% = IRR$

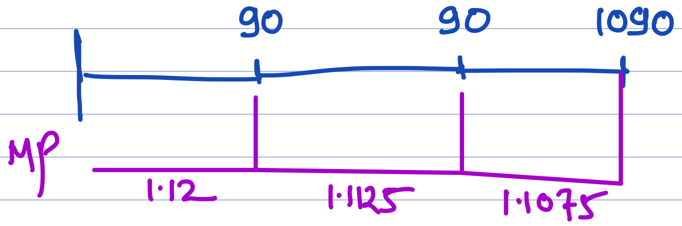
Assumption Redemption At PAR

$FV = 1000$
$CR = 10\%$
$YTM = 10\%$
$t = 5$ yrs

$MP = Int \times PVAF + RV \times PVF$
$= 100 \times 3.791 + 1000 \times 0.621$
$= 379 + 621$
$\boxed{MP = 1000}$

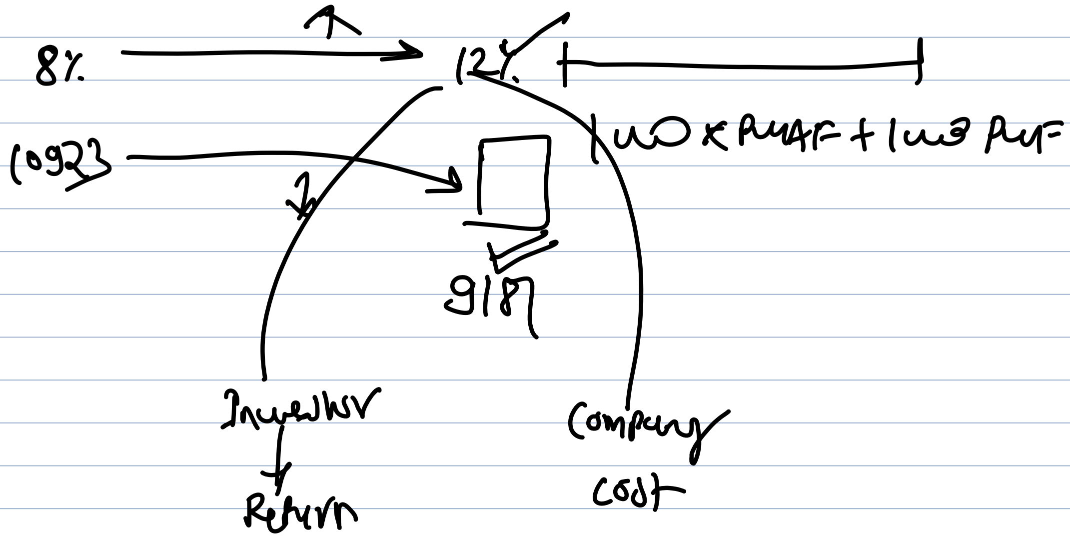
$YTM = CR$,	$MP = FV$
$YTM > CR$	$MP < FV$
$YTM < CR$	$MP > FV$

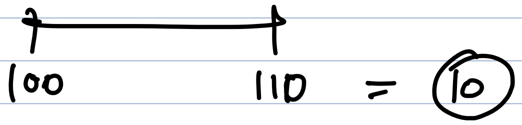
Q68



$FV = \frac{90}{1.12} + \frac{90}{1.12 \times 1.1125} \times \frac{1090}{1.12 \times 1.1125 \times 1.1075}$

$MP = FV \times Bete$





Pref

DURATION

Weighted avg years in which pv of Bond is recovered

FV = 1000
CR = 7%
YTM = 10%
t = 5

PV×yr	yr	CF	PVF@10%	PV	W →	W×y
63.63	1	70	0.909	63.63	0.0718	0.0718
115.64	2	70	0.826	57.82	0.0652	0.1304
157.71	3	70	0.751	52.57	0.0593	0.1779
191.24	4	70	0.683	47.81	0.0539	0.2156
3322.35	5	1070	0.621	664.47	0.7497	3.7485
3850.57				886.30		4.34

1. ytm > CR
2. Redemption is at par
3 mp < FV

Calculator
70 × 0.909 =
0.826 =
0.751 =
$\frac{1}{886.30} \times 63.63 =$

4.34 years ① = Σ weight$_{pv}$ × year

② = $\frac{\Sigma PV \times yr}{\Sigma PV} = \frac{3850.57}{886.30}$ = 4.34 years

③ = $\frac{1+ytm}{ytm} - \frac{(1+ytm)+t[c-ytm]}{c[(1+ytm)^t - 1]+ytm}$

$= \frac{1.10}{0.10} - \frac{(1.10)+5(0.07-0.10)}{0.07[1.1^5-1]+0.10}$

$= 11 - \frac{1.1-0.15}{0.1427}$

$= 11 - 6.66$

$= 4.34$ years

Q71

ⓐ 8% Mp = Int × PVAF + RV × PVF
= 80 × 3.993 + 1000 × 0.681
= 319 + 681
= 1000

ⓐ 6% mp = 80 × 4.212 + 1000 × 0.747
= 336.96 + 747
= 1083.96

	Int	principal	Total
8%	319	681	1000
6%	336.96	747	1083.96
	17.96	66	83.96

% increment of interest $\frac{17.96}{83.96} = 21.39\%$

principal $\frac{66}{83.96} = 78.61\%$

100%

6. $$D = \frac{1+ytm}{ytm} - \frac{(1+ytm) + t(c-ytm)}{c\left[(1+ytm)^t - 1\right] + ytm}$$

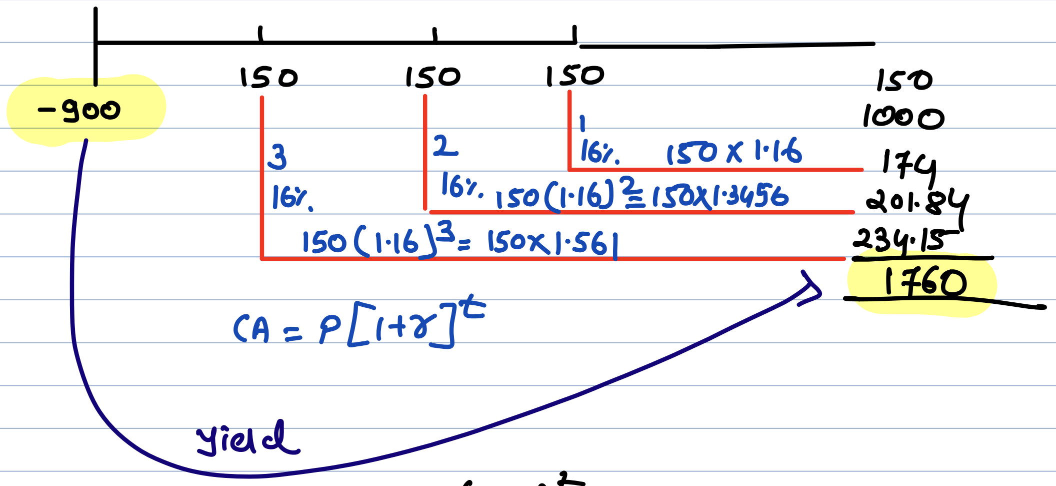
$$= \frac{1.07}{0.07} - \frac{1.07 + 0}{0.07\left(1.07^6 - 1\right] + 0.07}$$

$$= 15.29 - \frac{1.07}{0.1051}$$

$$= 15.29 - 10.18$$

$$= \underline{5.11 \text{ yrs}}$$

Q13



$$CA = P(1+r)^t$$

$$FV = PV(1+r)^t$$

$$1760 = 900(1+r)^4$$

$$(1.955)^{1/4} = (1+r)$$

$$(1.955)^{1/2 \times 1/2} = (1+r)$$

$$1.1825 = 1+r$$

$$r = 18.25\% \text{ p.a.}$$

Q74

Duration
↓
Macaulays Duration (years)

Volatility → ΔMP for 1% Δ in ytm
↓
Modified Duration
↓

$$MD = \frac{MACD}{1+ytm}$$

$$= \frac{4.247}{1.17}$$

$$= 3.63\% \rightarrow \Delta \text{ in MP for}$$

$1\% \rightarrow \Delta$ in ytm

opposite

Inverse Relationship

ytm	MP
1% ↑	3.63% ↓
1% ↓	3.63% ↑

Cross check

@18% ytm = Int × PVAF + RV × PVF
= 160 × 3.498 + 1000 × 0.370
= 559.68 + 370
= 929.68

@17% ytm = 964.24

% Δ in ytm = 1% ↑

% Δ in mp

$$\left[\frac{964.24 - 929.68}{964.24}\right] = 3.58\%$$

CONVEXITY

Modified Duration is good for small changes in ytm but it will give inaccurate answers for large changes in ytm

lets take ytm = 22% in previous example Δytm = 5% ↑

$$mp = 160 \times 3.167 + 1000 \times 0.303$$
$$= 506.71 + 303$$
$$= 809.71$$

$$mp @ 17\% = 964.24$$

$$\% \Delta mp = \frac{964.24 - 809.71}{964.24} = 16.03\% \downarrow$$ ✓

But According to MD $\% \Delta \text{ in } mp = 3.63 \times 5 = 18.15\% \downarrow$ ✗

$Fv = 1000$
$CR = 4\%$
$t = 5$
$ytm = 7\%$

$$MACD = \frac{1+ytm}{ytm} - \frac{(1+ytm) + t(c - ytm)}{c[(1+ytm)^2 - 1] + ytm}$$

$$= \frac{1.07}{0.07} - \frac{1.07 + 5(0.04 - 0.07)}{0.04[1.07^5 - 1] + 0.07}$$

$$= 15.29 - \frac{0.92}{0.086}$$

$$D = 4.59 \text{ years}$$

$$\text{Volatility} : MD = \frac{D}{1+ytm} = \frac{4.59}{1.07} = 4.29\%$$

ΔMP ↑ ↓
1% Δytm ↓ ↑

$$MD = \frac{\Delta MP}{\Delta ytm} = \frac{4.29}{1.00}$$

$$\Delta MD = \frac{\Delta(\Delta MP)}{\Delta ytm}$$

MP = Int × PVAF + RV × PVF

ⓐ $10\% = 40 \times 3.791 + 1000 \times 0.621 = 772.64$ PV_+

ⓑ $7\% = 40 \times 4.1 + 1000 \times 0.713 = 877$ PV_0

ⓐ $4\% = \qquad = 1000$ PV_-

Actual ΔMP

According to MD $= 4.29 \times 3$

$$\frac{PV_+ - PV_0}{PV_0} = -11.90\% = -12.87 + 0.97$$

$$\frac{PV_- - PV_0}{PV_0} = 14.02\% = 12.87 + 1.15$$

Avg $\frac{0.97 + 1.15}{2} = 1.06$

$-12.87 + 1.06 = -11.81$

$12.87 + 1.06 = 13.93$

DERIVATION

$$\%\Delta MP = -11.81\%$$

$$= -12.87 + \overset{\Delta}{1.06}$$

$$= \overset{\Delta MP}{-0.1287} + 0.0106$$

$$= -\underbrace{4.29}_{\frac{\Delta MP}{1\%\Delta YTM}} \times 0.03 + 0.0106$$

$$\frac{\Delta MP,\ 3\%\Delta YTM}{} \qquad \frac{\Delta(\Delta MP), 3\%\Delta YTM}{}$$

$$= -4.29 \times 0.03 + \frac{0.0106}{0.03} \times 0.03$$

$$\frac{\Delta MP}{1\%\Delta YTM} \qquad \frac{\Delta(\Delta MP)}{1\%\Delta YTM}$$

$$= -4.29 \times 0.03 + 0.3533 \times 0.03$$

$$= -4.29 \times 0.03 + \underbrace{\frac{0.3533}{0.03}}_{\frac{\Delta MD}{1\%\Delta YTM}} \times 0.03 \times 0.03$$

$$= -4.29 \times 0.03 + 11.78 \times 0.03 \times 0.03$$

$$\Delta MP = -[\text{Ann Mod Dur} \times \Delta YTM] + [\text{Convexity} \times \Delta YTM^2]$$

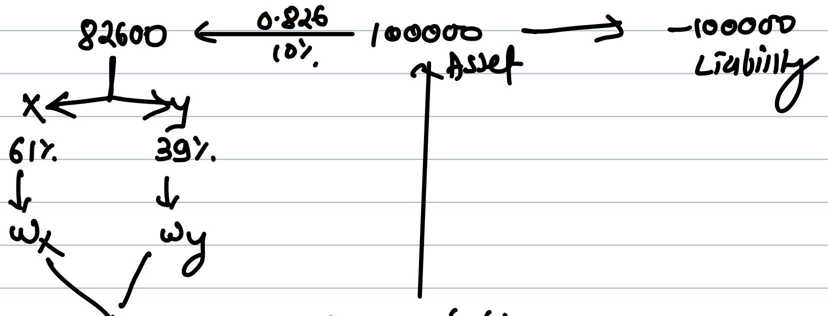
$$\text{Convexity} = \frac{\Delta MD}{\Delta YTM}$$

$$= \frac{\Delta\left[\frac{\Delta MP}{\Delta YTM}\right]}{\Delta YTM}$$

$$= \frac{\Delta[\Delta MP]}{\Delta YTM^2} = \frac{\left|\ \frac{\frac{PV_+ - PV_0}{PV_0} + \frac{PV_- - PV_0}{PV_0}}{2}\right.}{\Delta YTM^2} = \frac{PV_+ - PV_0 + PV_- - PV_0}{2\,PV_0\,\Delta YTM^2} = \frac{PV_+ + PV_- - 2PV_0}{2\,PV_0\,\Delta YTM^2}$$

BOND

Immunisation



$\Sigma w D_i = 2 =$ Investor's Horizon

Q90. Investor Horizon = Portfolio Duration $(\Sigma w_i D_i)$

$6 = w_A D_A + w_B D_B + w_C D_C$

$= 0.45 \times 6.86 + w_B 5.84 + (1 - 0.45 - w_B) 4.24$

$6 = 3.087 + \underline{5.84 w_B} + 2.332 - \underline{4.24 w_B}$

$0.581 = 1.6 w_B$

$w_B = 0.3631$

$w_C = 1 - 0.45 - w_B =$

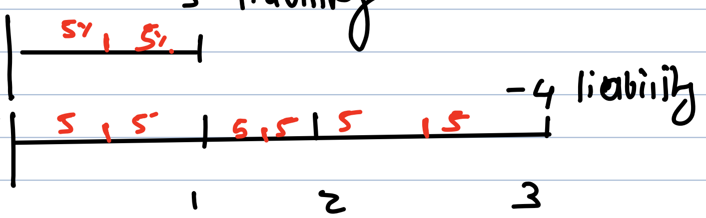
w_A

	Weights	New	Rebalancing
w_B	36.31%	24.66	-11.65
w_C	18.69%	30.34	+11.65
w_A	45%	45%	~~+~~

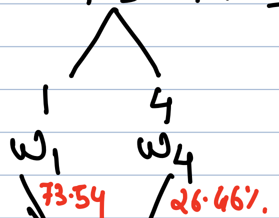
Q92

$\frac{5}{1.05^2} = 4.535$

$\frac{4}{1.05^6} = 2.985$



7.52 millions



$\frac{1+3}{2} =$ ②

D_p = Investor's $\overset{\text{Avg}}{\text{Horizon}}$ $= \sum w_i t_i = 1 \times \frac{4.535}{7.52} + 3 \times \frac{2.985}{7.52}$

$= 1 \times 0.6031 + 3 \times 0.3969$

$= \boxed{1.7938}$ years

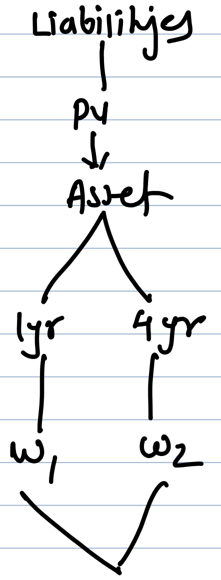
$D_p = \sum w_i D_i$

$= w_1 D_1 + w_4 D_4$

$1.7938 = w_1 \times 1 + (1 - w_1) \times 4$

$w_1 = 73.54\%$

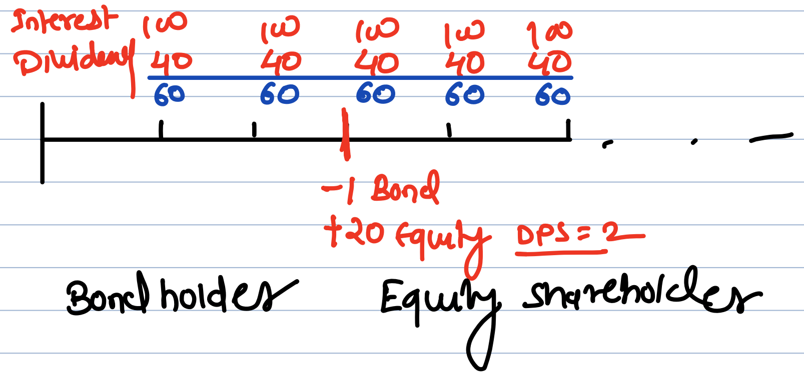
$W_4 = 26.46\%$

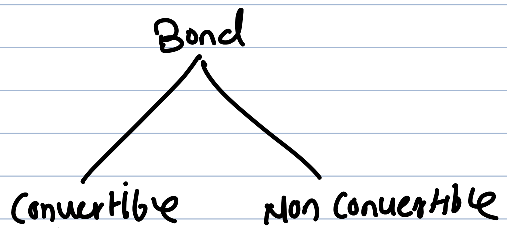


D_p = Investors Horizon = 1.793y

CONVERTIBLE BONDS

FV = 1000
CR = 10%
t = 5
MP_B : 900
MP_E = ₹40





↓
Bond that can be converted into certain No. of equity shares

① Conversion Ratio = 20
MP of Equity = 40
② Conversion value = 800
MP of Bond = 900
③ Conversion premium 100

④ Conversion premium Ratio = $\frac{100}{800} = \frac{MP_B - CV}{CV} = \frac{MP_B}{CV} - \frac{CV}{CV} = \frac{MP_B}{CV} - 1$

= 12.50%

FV = 1000
CR = 10%
t = 5

Conversion option
↓
Convertible Bond
900

Non convertible Bond
750
↓
⑤ Straight value of Bond
plain vanilla Bond.
$= Int \times PVAF + RV \times PVF$

$= Int \times PVAF + RV \times PVF$

or $= Int \times PVAF + CV \times PVF$
↓
Higher

CB		NCB		Equity (CV)
900	150	750	100	800

CB	> NCB
600	750
750	750
850	750

100
+ conversion option

CB	> CV
700	800
800	800
850	800

⑥ ∴ Minimum price of convertible Bond will be higher of straight value and conversion value.

⑦ % Downside Risk [How much premium we are paying for conversion option]

$$= \frac{MP_B - SV}{SV} = \frac{MP_B}{SV} - \frac{SV}{SV} = \frac{MP_B}{SV} - 1$$

$$= \frac{900 - 750}{750}$$

$$= \frac{150}{750}$$

$= 20\%$.

⑧ Conversion parity price
Break even market price
Market conversion price

$= CPP \times CR = MP_B$

$CPP \times 20 = 900$

$= CPP = \frac{900}{20} = 45 = \frac{MP_B}{CR}$

⑨ Favourable Income Differential $= 100 - 40 = 60$

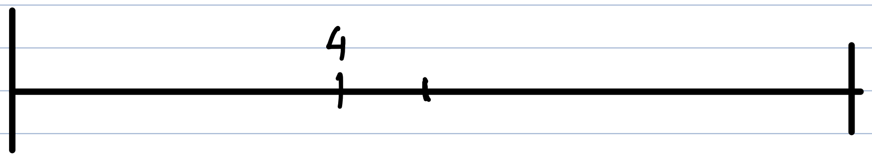
$= \frac{\text{Interest} - (DPS \times CR)}{CR}$

per share

⑩ premium payback period $= \frac{100}{60} = \frac{\text{Conversion premium}}{FID}$

$= 1.67$ yrs

BOND REFUNDING



0.42 lakhs
0.16 lesser
0.26
× 0.40

FV	1000	1000
CR	10%	6%
t	10 yrs	6 yrs
Total	100 cr	100 cr

Callable Bond

Floatation cost	1 cr	1.20 cr
	→ 0.60 balance	20 lakh
Discount	5 cr	—
	→ 3.0 balance	

+ New Bond +300
− Floatation cost −4
− old Bond −300
− Call premium on old Bond −42
+ tax saving on call premium +16.80
− Overlapping interest old Bond −7
+ tax saving on OL Interest 2.8
+ tax saving on unamortised (4.2)
Discount of issue on old Bond

+ Interest savings 6
− tax on interest savings −2.4
− Tax on incremental savings in Discount & Floatation cost −0.104

+ 3.5 crores 3.496
× PVAF ×10.675

written off

Incremental initial CF
– 29 lakhs outflow

PV
35 crore

37.32

BANK Dr 94
Issue cost 1 → Asset
Discount 5 → Asset
To Bond 100

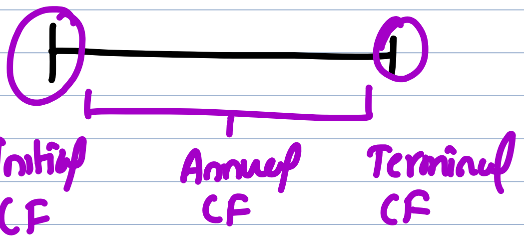
P&L 0.60
To Issue 0.10 × tax CIF
To Discount 0.50 × tax CIF

P&L (Interest) 10 COF × tax CIF
To BANK 10

–100
–100
~~0~~

+105
–100
+5

0
1–10
10



+ Issue Bond
– Floatation cost

– Interest
+ Tax saving
– Interest
– Floatation cost
– Discount

– Bond Repayment

NPV –29 +35 @2
+ve
–ve

Q106

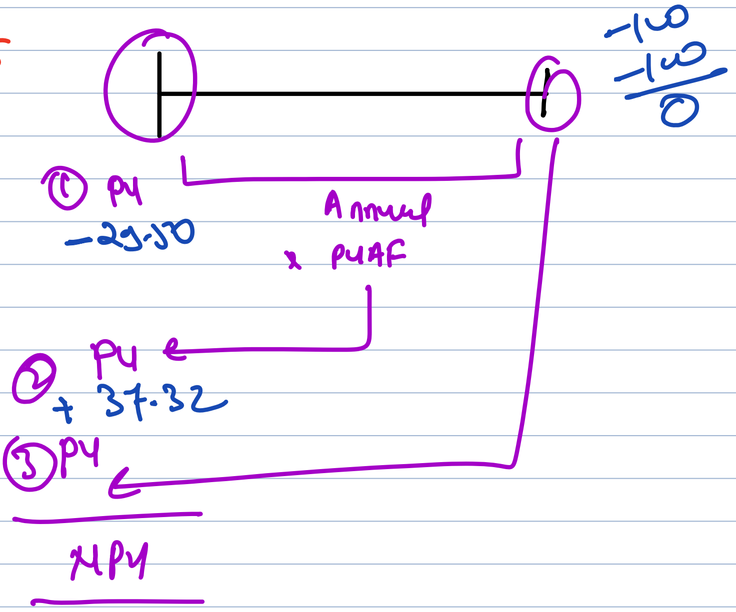
Particulars		Old	New	
FV		1000	100	
CR		14%	12%	2%
t		25	25	
Total		300 lakhs	300 lakhs	
No.		0.30 lakhs	0.30 lakhs	
Call premium	140 x 0.30	42 lakhs	NA	
Discount	30 x 0.30	7.5 9 lakh	—	
Issue cost		3 3.60 lakhs	4.00 lakhs	
overlapping interest				
300 x 14% x $\frac{2}{12}$		7		

$\frac{9}{30} \times 25 = 7.5$

0.30

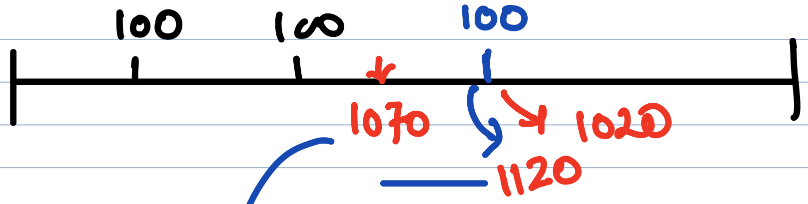
$\frac{3.60}{30} \times 25 = 3$

- 0.12



DIRTY PRICE & CLEAN PRICE

Dirty Price = Clean Price + Accrued Interest

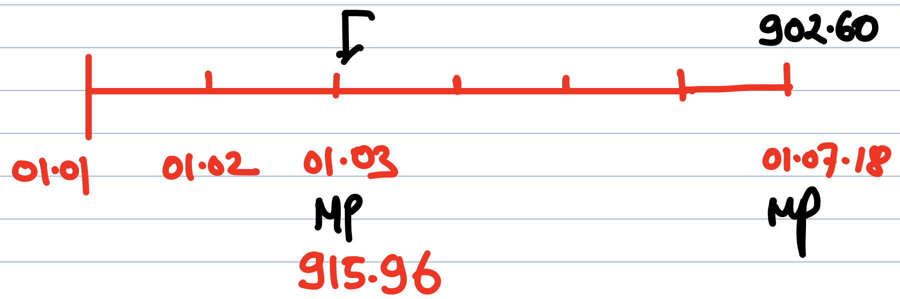


FV=1000
CR=10%

Dirty price = clean price + Accrued Int
1070 = 1020 + 50

31-12-xxxx
1120 = 1020 + 100

1020 = 1020 + 0



1
14
15
6%
12%

$MP_{\underline{01.07.18}}$ = Int × PVAF + RV × PVF
= 50 × 9.712 + 1000 × 0.417
= 902.60

$MP_{\underline{30.06.18}}$ = 902.60 + 50
= 952.60

6 − 6%
4 − 4%

$$MP_{\underline{01.03.18}} = 952.60 \times \left[\frac{1}{1+0.06\times\frac{4}{6}}\right]$$

Purchase price = 915.96 = Dirty price
(-) Accrued interest 16.67
$\left[50 \times \frac{2}{6}\right]$

Clean price/ Basic price 899.29

109] i] ICR = $\frac{PBIT}{Interest}$

$$= \frac{PBT + Int}{Interest}$$

$$= \frac{\frac{PAT}{(1-t)} + Int}{Int}$$

$$4 = \frac{\frac{2}{0.60} + 8 \times 0.10 + x \times 0.10}{8 \times 0.10 + x \times 0.10}$$

$$4 = \frac{4.133 + 0.10x}{0.80 + 0.10x}$$

$$3.20 + 0.40x = 4.133 + 0.10x$$

$$0.30x = 0.933$$

$$\boxed{x = 3.11 \text{ Crore}}$$

2) Net Depreciated Assets = 2x Mortgage Debt

$$30 + x \times 0.50 = 2 \times [8 + x]$$

$$30 + 0.50x = 16 + 2x$$

$$14 = 1.5x$$

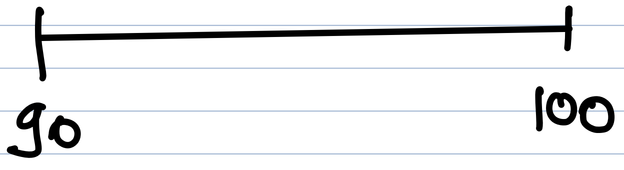
$$\boxed{x = 9.33}$$

③ $$\frac{P}{E} = 0.50$$

$$\frac{8 + x}{40} = 0.50$$

$$8 + x = 20$$

$$\boxed{x = 12}$$



FV = 100

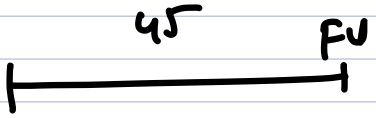
discount Rate = 10%

360 days

$\text{Yield} = \frac{10}{90}$

$\xrightarrow{} \text{MP } 90$

365



$\text{yield} = \frac{\text{Return}}{\text{MP}} \times \frac{360}{45} \times 100$

$6\% \times \frac{45}{360} = 0.75\%$ $\quad x(1-0.0075) \quad x$

$992.50 \quad 1000$

$= \frac{7.5}{992.50} \times \frac{360}{45} \times 100 = 6.045\%$

$8\% \times \frac{45}{360} = 1\%$ $\quad x(1-0.01) \quad x$

0.25% $\quad 990 \quad 1000$

2.5

$= \frac{10}{990} \times \frac{360}{45} \times 100 = 8.08\%$

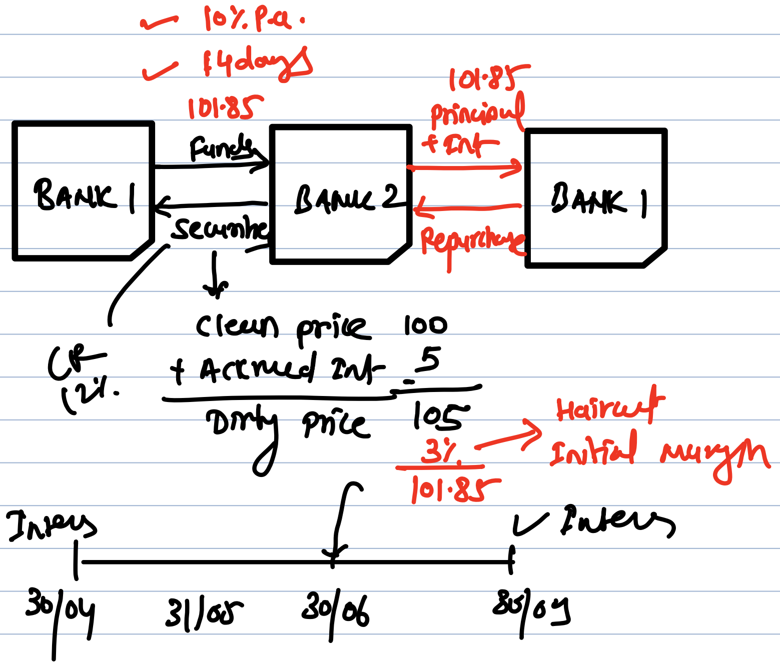
$$x(1-0.0075) - x(1-0.01) = 2.5$$

$$0.9925x - 0.99x = 2.5$$

$$0.0025x = 2.5$$

$$\boxed{x = 1000}$$

Repo & Reverse Repo



Portfolio Management

1. $R_p = \omega_x R_x + \omega_y R_y$

①

x	100000 × 200	20000000	0.5714
y	50000 × 300	15000000	0.4286
		35000000	

② $R_x = \frac{D + CA}{P_0} = \frac{10 + [220-200]}{200} = \frac{30}{200} = 15\%$

$R_y = \; = \frac{3 + [290-300]}{300} = \frac{-7}{300} = -2.33\%$

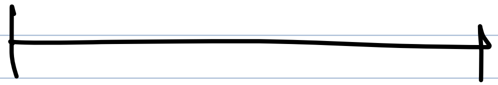
14-15 15-16

x 220 3 × 3 = 9

y 290

3		×	3	=9	220	
Dividend			CA	Joint prob.		%
0.20	10	0.20	0	✓ 0.04	10	0.40
0.20	10	0.50	30	0.10	40	
0.20	10	0.30	60	0.06	70	
0.30	15	0.20	0	0.06	15	
0.30	15	0.50	30	0.09	45	
0.30	15	0.30	60	0.18	75	
0.50	20	0.20	0	0.10	20	
0.50	20	0.50	30	0.25	50	
0.50	20	0.30	60	0.15	80	
100%		100%		100%		

$$E_p = w_x \underline{R_x} + \underline{w_y} \underline{R_y}$$



x 220 × 100000 = 22000000

y 290 × 50000 = 14500000

36500000

$$\gamma_{AB} = \frac{Cov_{AB}}{\sigma_A \sigma_B} = \frac{80}{100} = \underline{0.80}$$

$$\beta_A = \frac{Cov_{AM}}{\sigma_M \sigma_M} = \frac{Cov_{AM}}{\sigma_M^2} = \frac{\gamma_{AM} \sigma_A \cancel{\sigma_M}}{\cancel{\sigma_M^2}} = \frac{\gamma_{AM} \sigma_A}{\sigma_M}$$

→ Market

$$\frac{5}{10} = \underline{0.50}$$

$$\frac{70}{100}$$

= 0.70 It represents Direction & Extent

+ve = same

-ve = opposite

RA

Rm = 10↑ × 0.70 = 7%↑

5↓ × 0.70 = 3.5%↓