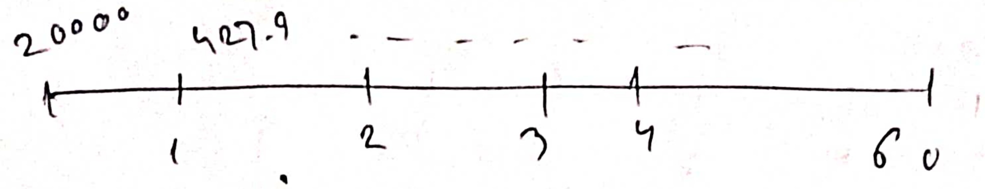
1)



$20000 = 427.90\, a_{\overline{60}|} @ i^{12}/12 = 1$

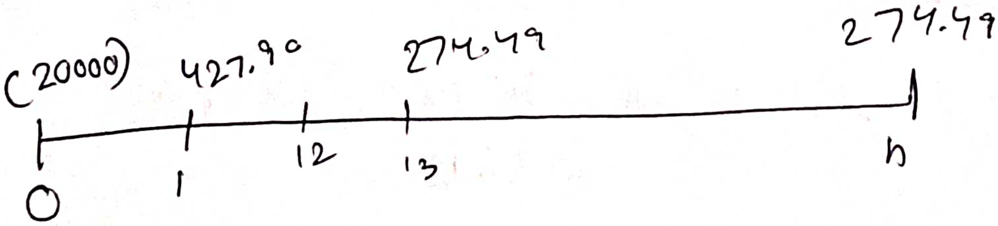
$= \text{"} \left(\frac{1-(1+i)^{-60}}{i} \right)$

$46.73989 = \frac{1-(1+i)^{-60}}{i}$

$i = \frac{i^{12}}{12} = 0.008583 = 0.8583\%$

$i^{12} = 10.2996\%$

$1+i = \left(1 + \frac{i^{12}}{12}\right)^{12} \qquad i = 10.79\%$



Capital left after 1yr $= 427.90\, a_{\overline{12}|} @ 0.008583$

$= 427.90 \left(\frac{1 - 1.008583^{-12}}{0.008582} \right)$

$= 4279\, a_{\overline{12}|} @ 0.008583$

$20000 = 5134.8\, a^{12}_{\overline{1}|} @ i$

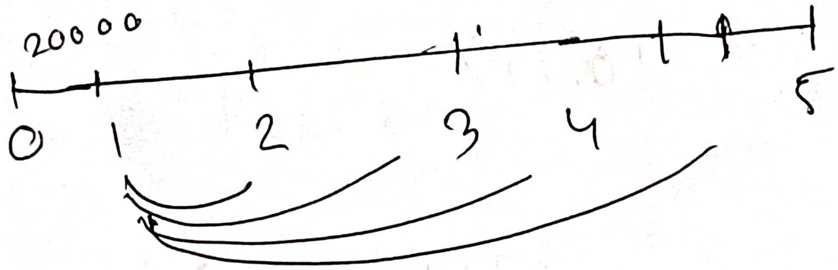
$= \text{"} \left(\frac{1 - 1.1079^{-1}}{0.102996} \right)$

$20000(1.1079) - 5134.8\, s^{12}_{\overline{1}|} @ 1.8\%$

$5134.8 \left(\frac{1.108^{+1} - 1}{0.102996} \right)$

∴ ~~20000(1.107)~~ −

ii)



∴ Capital left after 1 year $= 5134.8\, a_{\overline{47}|}^{(12)}$ @ 1.8%

$= 16775.98$

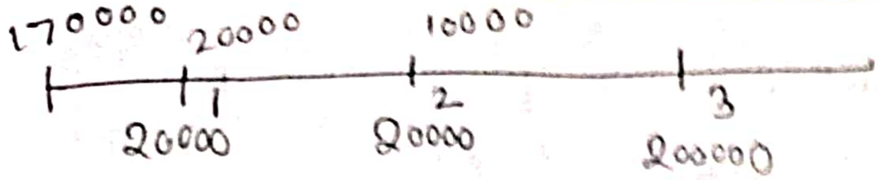
$16775.98 = 274.49\, a_{\overline{t}|}^{(12)}$ @ 10.8% ×12

$= 12 \times$ '' $\left(\frac{1-\cancel{(1+i)}\,(1.108)^{-t}}{0.102996}\right)$

$0.4754 = (1.108)^{-t}$

$t = 7.25$ yr

2iii) a)



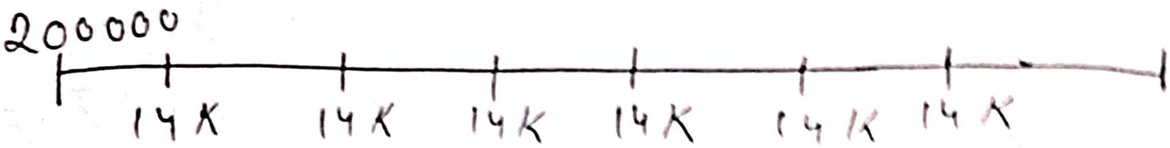
$$1700000 = 20000\,(1+i)^{-1} + 20000\,(1+i)^{-2} + 200000\,(1+i)^{-3}$$
$$-20000\,(1+i)^{-1} - 10000\,(1+i)^{-2}$$

$$170000 = 10000\,(1+i)^{-2} + 200000\,(1+i)^{-3}$$

$$i = 0.07424 = 7.424\,\%$$

~~b) 200000 = 14000~~

b)



$$200000 = 14000\, a_{\overline{6}|} @\, i\% = 14000\left(\frac{1-(1+i)^{-6}}{i}\right)$$

$$\frac{100}{7} = \frac{1-(1+i)^{-6}}{i} = 14.285714$$

$$7 - 7(1+i)^{-6} - 100i = 0$$

$$200000 = 14000\, a_{\overline{6}|} @\, i\% + 200000\,(1+i)^{-6}$$

$$200 = 14\left(\frac{1-(1+i)^{-6}}{i}\right) + 200\,(1+i)^{-6}$$

$$200i = 14 - 14(1+i)^{-6} + 200i(1+i)^{-6}$$

$$i = 7\%$$

2b) **Project A**

$$-170000 - 20000(1.06)^{-1} - 10000(1.06)^{-2} + 20000(1.06)$$

$$+ 20000(1.06)^{-2} + 200000(1.06)^{-3}$$

$$= -170000 + 10000(1.06)^{-2} + 200000(1.06)^{-3}$$

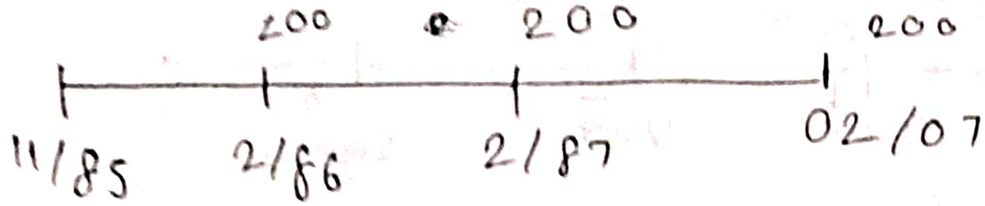
$$= 6823.82$$

Project B

$$-200000 + 14000\,a_{\overline{6|}} @ 6\% + 200000(1.06)^{-6}$$

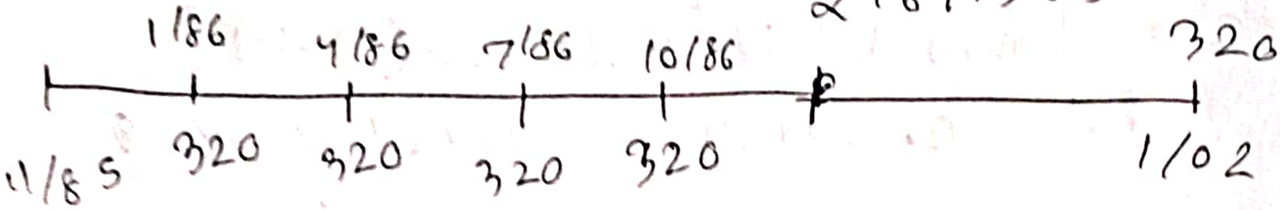
$$= 9834.65$$

3)



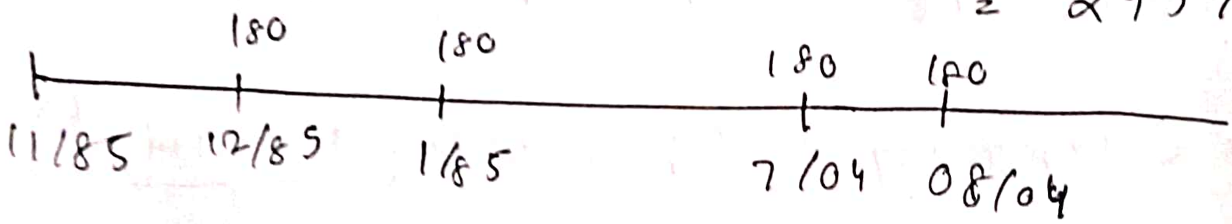
Annuity $1 = 200(v)^{1/4}(\ddot{a}_{22}@\ 8\%)$

$= 2161.363$



Annuity $2 = 320(1+i)^{1/12}(a^{(4)}_{\overline{16.25}|}@\ 8\%)$

$= 2957.872$



Annuity $3 = 180(a^{(12)}_{\overline{18.75}|}@\ 8\%) = 1786.665$

Total $= 6899.90$

$\therefore\ 6899.90 = A(1+i)^{1/4}(a^{(12)}_{\overline{21.5}|})$

$\therefore\ A = 656.56$

4) From the first principles,

$(I\ddot{a})_n = 1+2v+3v^2+4v^3+5v^4+\dots+nv^{n-1}$ @ I

Multiplying both the sides by 'v'

$v(I\ddot{a})_n = v+2v^2+3v^3+4v^4+5v^5+\dots+nv^n$

Subtracting,

$(1-v)(I\ddot{a})_n = 1+v+v^2+v^3+v^4\dots+v^{n-1}-nv^n$

$= (1-v^n)/(1-v)-nv^n$

$d(I\ddot{a})_n = \ddot{a}_n - nv^n$

$(I\ddot{a})_n = \dfrac{\ddot{a}_n - nv^n}{d}$ Hence proved

5) i) TWRR = $\frac{16.4}{12.4} - 1 = 0.3226 = 32.26\%$

TWRR of equity fund $\frac{15.5}{12.1} - 1 = 28.10\%$

ii) a) $1240(1+i) + 1310(1+i)^{3/4} + 1480(1+i)^{1/2} + 1580(1+i)^{1/4}$

$= 4 \times 1640$

$i = 29.32\%$

b) $400 \times \ddot{s}_{\overline{1}|}^{(4)} = 100(16.4)\left(\frac{1}{12.4} + \frac{1}{13.1} + \frac{1}{14.8} + \frac{1}{15.8}\right)$

$\ddot{s}_{\overline{1}|}^{(4)} = 1.1801$

$i = 29.8\%$

iii) a) $1210(1+i) + 920(1+i)^{3/4} + 1030(1+i)^{1/2} + 1310(1+i)^{1/4} = 4 \times 1550$

$i = 67.5\%$

b) $400 \times \ddot{s}_{\overline{1}|}^{(4)} = 100(15.5)\left(\frac{1}{12.1} + \frac{1}{9.2} + \frac{1}{10.3} + \frac{1}{13.1}\right)$

$\ddot{s}_{\overline{1}|}^{(4)} = 1.4135$

$i = 70.88\%$

6) i) $160000 = X a_{\overline{10|}} @ 8\%$ $X = 23844.65$

ii) Loan o/s after 4th Pay

$= 23844.65 (a_{\overline{6|}} @ 8\%) = 110231.44$

$\therefore Y a_{\overline{6|}} = 110231.44$ $Y = 25309.72$

iii) Loan o/s after 7th Pay =

$25309.72 (a_{\overline{3|}} @ 10\%) = 62942.74$

$\therefore Z a_{\overline{3|}} @ 9\% = 62942.74$

$Z = 24865.77$

$\therefore$ Yield $\Rightarrow 160000 + 1465 (a_4) - 499.95 (a_7)$

$- 24865.77 (a_{10}) = 8$

$\therefore i = 8.4\%$

8 i) $PV = 2.7 + 0.2 a_{\overline{3}|} @ 1\%$ —— (i)

$0.1 v^3 + a_{\overline{10}|} (0.25v + 0.2v^2 + 0.1v^3) @ 1\%$ —— (ii)

$\therefore$ (i = ii) $i = 9.28\%$

ii) $0.1 v^3 + 0.85 a_{\overline{10}|} v^3$

$= [0.1 v^3 + 0.85 a_{\overline{10}|} v^3 - 2.7 - \cancel{0.2 a_{\overline{3}|}}$

$- 0.2 a_{\overline{3}|} @ (i = 10\%)$

$\therefore = 4.19 - 3.19 = 1.0089$

as NPV is +ve, its good to invest

9) i) TWRR

$$(1+i)^3 = \frac{33}{30.50} \times \frac{(41.05 - 4.5)}{38+6} \times \frac{45.6}{41.05} \times \frac{47}{(45.6-2.50)}$$

$(1+i)^3 = 1.081967 \times 0.937179 \times 1.11084 \times 1.090487$

$(1+i)^3 = 1.228313$

$(1+i) = 1.070951$

TWRR = 7.0951 %

MWRR

$30.5 \times (1+i)^3 + 6 \times (1+i)^{2.25} + 4.5 \times (1+i)^{1.5} - 2.5 \times (1+i)^{0.5} = 47$

At i = 7% LHS = 46.76

At i = 7.5% LHS = 47.37

By interpolation
MWRR = 7.206%

ii) Linked rate of return

Year 2011 - equation of value

$30.5(1+i) + 6(1+i)^{0.25} = 38.50$

i = 6% LHS = 38.42

i = 6.5% LHS = 38.57

By interpolation, i = 6.266%

Year 2012 - equation of value

$38.50(1+i) + 4.50(1+i)^{0.50} = 45$

i = 4.5% LHS = 44.83

i = 5% LHS = 45.03

By interpolation, i = 4.92 %

Year 2013 - eqⁿ of value

$45(1+i) - 2.50(1+i)^{0.5} = 47$

$i = 10\%$ LHS $= 46.88$

$i = 10.5\%$ LHS $= 47.097$

By interpolation $i = 10.276\%$.

iv) TWRR eliminates the effect of the cashflows amount and timing and therefore gives a fairer basis of assessing the investment performance for the fund. MWRR is sensitive to the amount and timing of the net cashflows.

11) i) TWRR $\Rightarrow (1+i)^2 = \frac{500}{460}\left(\frac{580+50}{500+40}\right)\left(\frac{4}{550}\right)$

$= 1.44$

$X = 655.78$

ii) MWRR $= 460(1+i)^2 + 40(1+i)^{7/4} - 50(1+i)$

$= 655.78$

MWRR $= 19.85\%$

iii) $460(1+i) + 40(1+i)^{3/4} = 600$ $\quad i = 20.445\%$

$(1+i) = \frac{655.78}{550} = 1.1923$

$\therefore$ LIRR $= (1+i)^2 = 1.1923(1.2044) = \cancel{1.4383}$

$= 19.83\%$

(2) ii) a) DPP $\Rightarrow -800(1+i)^t - 50(1+i)^{t-1} + 100(\bar{s}_{\overline{t-2}}\ @7\%)$

$\boxed{t = 17.8\ yrs}$ $\quad = 0$

b) AV $\Rightarrow 100(\bar{s}_{\overline{4.25}}\ @\ 6\%) = 480$

$\therefore$ AV $= 480000$

(iv) $i = 6\%$ $\quad 100\,\bar{s}_{\overline{1}|} = 102.971$

$\therefore$ DPP $\Rightarrow -800(1+i)^t - 50(1+i)^{t-1}$ ~~+102.975~~

$+102.971\ \bar{s}_{\overline{t-2}|}\ @7\% = 0$

$t = 18\ yr$

$-800(1+i)^{18} - 50(1+i)^{11} + 102.97\, s_{\overline{16}|} @ 7\% = 9.7714$

$\therefore AV = 9.7714(1+i)^{4} + 100\, \bar{s}_{\overline{4}|} @ 6\% = 462.79$

$AV = 462790$ (Ans)

13) i) $X a^{(12)}_{\overline{25}|} @ 7\% = 9880$

$X = 821.76$ $\qquad \frac{X}{12} = 68.48$

$= 6848$

ii) Loan O/S after 10/03/29

$X a^{(12)}_{\overline{37/3}|} @ 7\% = 648600$

iii) Loan o/s after 10/9/26 $\to X a^{(12)}_{\overline{83/6}|} @ 7\%$

" " " 10/10/26 $\Rightarrow X a^{12}_{\overline{13.75}|} @ 7\%$

$\therefore$ Capital repaid $= X \left(\frac{v^{13.75} - v^{83/6}}{i^{2}} \right) @ 7\% = 26.86$

iv) Capital repay continue in 12 installment is

$X \left(a^{12}_{\overline{22/3}|} - a^{12}_{\overline{19/3}|} \right) @ 7\% = 516.2$

Total interest $= X - 516.20 = 305.56$