→ Loan = Rs. 10L, n = 5 years, i = 10%, installment starts 1 year hence, what is the amount of installment?

0	1	2	3	4	5
10,00,000	$\frac{x}{1.10}$	$\frac{x}{(1.10)^2}$	$\frac{x}{(1.10)^3}$	$\frac{x}{(1.10)^4}$	$\frac{x}{(1.10)^5}$

Present value of constant annuity.

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

$$= \frac{1}{0.10} - \frac{1}{0.10 \times (1.10)^5}$$

$$= 3.7907$$

$$\frac{10,00,000}{3.7907} = 263803$$

263803 × 5 = Rs. 1319015

2.63 → In 1L

2.63 → Pr 1.63

2.63 → In 0.10 × (10 − 1.63)

2.63 → Pr

⋮

→ Loan Amortization Schedule

7/2/23

→ Problem 1

(a) $10,000 \times (1+0.12)^{10}$

(b) $10,000 \times (1.06)^{20}$

(c) $10,000 \times (1.01)^{120}$ → $m \times n$

$\hookrightarrow 1 + \frac{r}{m}$

(d) $10,000 \times \left(1 + \frac{0.12}{365}\right)^{365 \times 10} \approx 33,195$

(e) $10,000 \times e^{nr} = 10,000 \times (2.71)^{10 \times 0.12} = 33201$

12% Annual Periodic Return rate

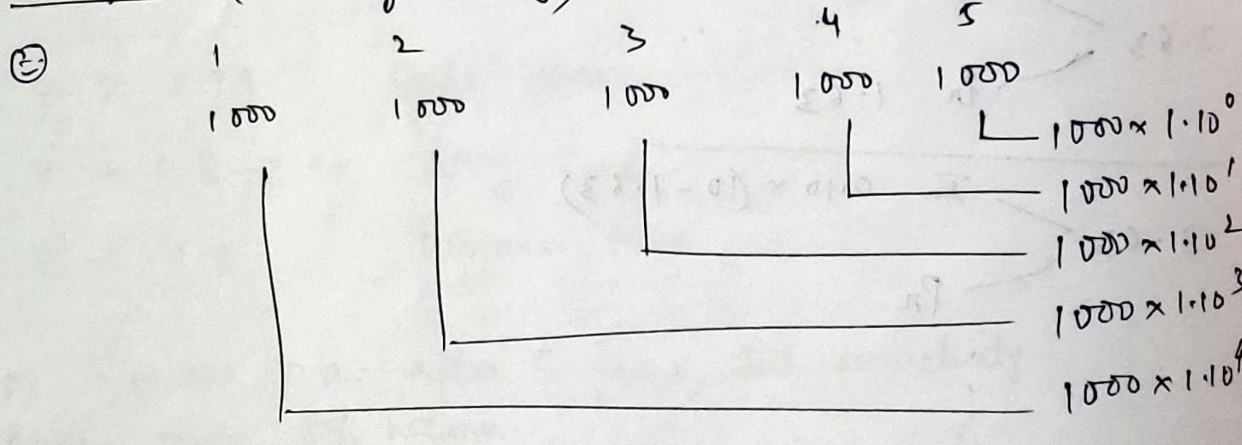
Effective annual return $= (1+0.06)^2 - 1 = 12.36$

↑ in case of semi-annual compounding.

~~Problem 2~~

→ Annuity cash flow → assume end of period → ordinary annuity
→ if beginning → annuity due

Example :- (ordinary Annuity)



→ For annuity due, each term will be multiplied by $(1+i) = 1.10$

→ FVIFA (ordinary) $= A\left[\frac{(1+i)^n - 1}{i}\right]$

Annuity due $= A\left[\frac{(1+i)^n - 1}{i}\right] \cdot (1+i)$

→ Present value of annuity :-

☺ 1 2 3 4 5

1000 1000 1000 1000 1000

$$\frac{1000}{(1+i)}$$

$$\frac{1000}{(1+i)^2}$$

.

$$\frac{1000}{(1+i)^5}$$

→ For annuity due in this case also, multiply by $(1+i)$.

→ <u>Problem 2</u>

☺ 1 2 3 4 5 6 7 8 9 10

5000 5000 . . - - - - - 5000

$$\frac{5000}{(1.10)^3}$$

:

$$\frac{5000}{(1.10)^9}$$

$$PV_2 = 5000 \times \left[\frac{1}{0.10} - \frac{1}{0.10(1.10)^7} \right] = 24,342$$

$$PV_0 = \frac{24342}{(1.10)^2}$$

→ ☺ 1 2 3 4 5 - - - - 10

5000 . . . . 5000 7000 - - . . 7000

$$5000 \times \left[\frac{1}{0.08} - \frac{1}{0.08(1-0.08)^4} \right] + \frac{7000}{(0.08)^4} \left[\frac{1}{0.08} - \frac{1}{0.08(1-0.08)^6} \right]$$

→ Alternative :

$7000 \times PVIFA_{(0.08, 10)} - 2000 \times PVIFA_{(0.08, 4)}$

→ <u>Problem 4</u>

(c)

1	360m	361	300
7000	$7000 \left(\frac{0.11}{12}\right)$	x	$\left(\frac{0.09}{12}\right)$
3000	$3000 \left(\frac{0.07}{12}\right)$		

$$7000 \times FVIFA\left(\frac{0.11}{12}, 360\right) + 3000 \times FVIFA\left(\frac{0.07}{12}, 360\right)$$

$= 19631638 + 3659913$ (invested 36L)

$= 2{,}32{,}91551$

↑

$$= x \times PVIFA\left(\frac{0.09}{12}, 300\right)$$

$= x \times 119.16$

$\Rightarrow x = 1{,}95{,}461.849$

→ <u>Problem 5</u>

$$\left(1 + \frac{0.11}{4}\right)^4 - 1$$

→ <u>Problem 6</u>

$$\left(1 + \frac{0.07}{12}\right)^{12} - 1$$

→ <u>Problem 7</u>

Loan = 80% of 16,00,000 = 12,80,000

360 monthly installments.

$A \times PVIFA(i, 360) = 12.80L$

$$\left[\frac{1}{i} - \frac{1}{i(1+i)^n}\right] \times 10{,}000 = 12{,}80{,}000 \qquad (n = 360)$$

Take $i = 9\%$ [use solver in calculator]

12, 42, 818

$APR = 0.7228\% \times 12 = 8.67\%$

$$EAR = \left(1 + \frac{0.7228}{100}\right)^{12} - 1 \approx 9.02\%$$

→ Problem 8

1	2	3	...	40
1040	$1040(1.04)$	...	...	$1040(1.04)^{39}$

$1040 \times (1.04) \times (1.08)^{38}$

$1040 \times (1.08)^{39}$

$$\text{FV of growing annuity} = \frac{(1+i)^n - (1+g)^n}{i-g}$$

$$= \frac{(1.08)^{40} - (1.04)^{40}}{0.08 - 0.04} = 4{,}40{,}011$$

→ Problem 9

10L, 5 annual investments, 10%

$10{,}00{,}000 = A \times PVIFA(0.10, 5)$

$= A \times 3.7907$

$A = 2{,}63{,}\cancel{797}\ 797$

Loan Amortization Schedule

Year	Principal at beginning of yr.	Instalment amt.	Interest portion	Principal Repayment
1	10,00,000	2.63L	1,00,000	1.63L
2	8,36,203	2.63L	83,620	1,80,177
3	.	.	.	
4	|	|	|	
5	|	|	x	y

$x + y = 2,63,797$

→ Problem 11

$$\text{Installment} = \frac{2,63,797}{1.10} = 2,39,815$$

↓

equiv. to 4 yr loan on principal 10L − 2.39L.