Unit 1.

Commercial Arithmetic

Find the Amt which After 4 years @ 8% p.a. ~~will~~ on a principle of ₹ 9600:-

$$S.I = \frac{P \times r}{100}$$

$$= \frac{9600 \times 4 \times 8}{100}$$

$$= 3072$$

$$A = P + I$$

$$= 9600 + 3072$$

$$A = ₹12672$$

$$A = P + SI$$

$$= P + \left(\frac{P \times r}{100}\right)$$

$$=$$

In how many yrs will sum of money be double at 25% per annum. SI

P = Principal

A = 2P

We know

$$A = P\left(1 + \frac{nr}{100}\right)$$

$$\therefore 2P = P\left(1 + \frac{25n}{100}\right)$$

$$2 = 1 + \frac{n}{4}$$

$$1 = \frac{n}{4}$$

$$n = 4 \text{ yrs.}$$

In how much time will ₹ 5000 @ 3% p.a produce the same intt as ₹ 10000 in 2 years @ 3% p.a SI?

$SI_1 = SI_2$

$$\frac{5000 \times n \times 3}{100} = \frac{10000 \times 2 \times 3}{100}$$

$$50n \times 3 = 600$$

$$150n = 600$$

$$n = 4 \text{ yrs.}$$

A person lent ₹ 8000 for 4 yrs & ₹ 6000 for 3 yrs @ same rate of intt. If he received ₹ 3000 in total as simp. intt. find rate.

$P_1 = 8000$ $P_2 = 6000$

$n_1 = 4$ $n_2 = 3 \text{ yrs.}$

$r_1 = r_2 = r$

$SI_1 + SI_2 = 3000$

$$\frac{8000 \times 4 \times r}{100} + \frac{6000 \times 3 \times r}{100} = 3000$$

$$\frac{32000r + 18000r}{100} = 3000$$

$$32000r + 18000r = 300000$$

$$50000r = 300000$$

$$r = 6\%$$

Nitin borrowed ₹ 30000 from 2 friends. For 1 loan he paid 5% for the other he paid 7% PA After 1 year he paid ₹ 1600 intt. how much money did he borrow at each rate of intt.

let $P_1 + P_2 = 30000$

$P_2 = 30000 - P_1$

$n_1 = n_2 = 1 \text{ yrs}$

$r_1 = 5\%$, $r_2 = 7\%$

$SI_1 + SI_2 = 1600$

$$\frac{P_1 n_1 r_1}{100} + \frac{P_2 n_2 r_2}{100} = 1600$$

$$\frac{P_1 5}{100} + \frac{(30000 - P_1) 7}{100} = 1600$$

$$\frac{5P_1 + 210000 - 7P_1}{100} = 1600$$

$$210000 - 2P_1 = 160000$$

$$2P_1 = 210000 - 160000$$

$$2P_1 = 50000$$

$$P_1 = 25000$$

$$\therefore P_1 + P_2 = 30000$$

$$25000 + P_2 = 30000$$

$$P_2 = 5000$$

A sum of money amounts to ₹ 6600 in 2 yrs & ₹ 7200 in 4 years. Find the sum & rate of int.

$A_1 = 6600$

$A_2 = 7200$

$n_1 = 2$ yrs

$n_2 = 4$ yrs.

$P_1 = P_2$.

$r_1 = r_2 = r$

$$A_1 = P_1\left[1 + \frac{n_1 r_1}{100}\right]$$

$$6600 = P_2\left[1 + \frac{2r_1}{100}\right]$$

$$= P_1\left[1 + 0.02r\right]$$

$$A_2 = P_2\left(1 + \frac{4r_2}{100}\right)$$

$$7200 = P_2\left(1 + 0.04r\right)$$

$\therefore 6600 = P_1 + 0.02 P_1 r$ — (1)

$\therefore 7200 = P_1 + 0.04 P_1 r$ — (2)

$7200 = P_1 + 0.04 P_1 r$

$\Rightarrow 6600 = P_1 + 0.02 P_1 r$

$600 = 0.02 P_1 r$

Dividing (2) by (1)

$$\frac{7200}{6600} = \frac{P(1 + 0.04r)}{P(1 + 0.02r)}$$

$$12(1 + 0.02r) = 11(1 + 0.04r)$$

$$12 + 0.24r = 11 + 0.44r$$

$$12 - 11 = 0.44r - 0.24r$$

$$1 = 0.2r$$

$$r = \frac{1}{0.2}$$

$\therefore r = 5\%$

Compound Int:-

$P = ₹1000$
$r = 10\%$
$n = 3$

For 1st year

$$SI = \frac{1000 \times 1 \times 10}{100}$$
$$= 100$$
$$A = 1000 + 100$$
$$= 1100$$

For 2nd year

$$SI = \frac{1100 \times 1 \times 10}{100}$$
$$= 110$$
$$A = 1100 + 110$$
$$= 1210$$

For 3rd year

$$SI = \frac{1210 \times 1 \times 10}{100}$$
$$= 121$$
$$A = 1210 + 121$$
$$A = 1331$$

$$SI = \frac{1000 \times 3 \times 10}{100}$$
$$= 300$$
$$A = 1000 + 300$$
$$A = 1300$$

$CI > SI$

Formulae for CI

1) SI for 1st year = CI for 1st year.
2) $I = P\left[\left(1 + \frac{r}{100}\right)^n - 1\right]$
3) $A = P + CI$
4) $A = P\left(1 + \frac{r}{100}\right)^n$

Q) Find the CI & accumulated amt after 4 years of a principal sum of ₹ 20000 @ 5% PA.

$P = ₹20000$
$r = 5\%$
$n = 4$

$$CI = P\left[\left(1 + \frac{r}{100}\right)^n - 1\right]$$
$$= 20000\left[\left(1 + \frac{5}{100}\right)^4 - 1\right]$$
$$= 20000\left[\left(\frac{105}{100}\right)^4 - 1\right]$$
$$= 20000\left[(1.05)^4 - 1\right]$$
$$= 20000\left[1.2155 - 1\right]$$
$$= 20000\left[0.2\right]$$
$$= ₹9386.56$$

Q2 Given $P = ₹10000$, $n = 3$, $r = 9\%$

$$CI = P\left[\left(1+\frac{r}{100}\right)^n - 1\right]$$
$$= 10000\left[\left(1+\frac{9}{100}\right)^3 - 1\right]$$
$$= 10000\left[(1+0.09)^3 - 1\right]$$
$$= 10000\left[(1.09)^3 - 1\right]$$
$$= 10000\left[1.295029 - 1\right]$$
$$= 2950.29$$

$$A = 10000 + 2950.29$$
$$= 12950.29$$

Q3) What sum of money will amount to ₹73,502.58 in 3 years at 7% p.a. compound int.

$$A = P\left(1+\frac{r}{100}\right)^n$$

$P = ?$, $A = 73502.58$, $n = 3$, $r = 7\%$

$$73502.58 = P\left(1+\frac{7}{100}\right)^3$$
$$= P\left(1+0.07\right)^3$$
$$= P\left(1.07\right)^3$$
$$73502.58 = 1.225043\,P$$
$$P = ₹60000$$

Q4 In how many years would ₹ 4,30,000 become ₹ 4,97,778.75 at 5% p.a compounded.

Sol $A = 497778.75$, $P = 430000$, $I = 5\%$ p.a.

$$A = P\left(1+\frac{R}{100}\right)^n$$

$$497778.75 = 430000\left(1+\frac{5}{100}\right)^n$$
$$= 430000\,(1.05)^n$$
$$1.157625 = (1.05)^n$$
$$\therefore n = 3 \text{ years.}$$

Q5 A sum of ₹ 6,55000 is invested in a fixed deposit giving 10% p.a com. I. Find the int in the 4th year.

Sol $C.I = P\left[\left(1+\frac{r}{100}\right)^n - 1\right]$ $\quad C.I = P\left(1+\frac{r}{100}\right)^{n-1}$

$$= 655000\left[1+\frac{10}{100}\right]$$
$$= 655000\left(1+\frac{10}{100}\right)^{4-1}\left(\frac{10}{100}\right)$$
$$= 655000\,(1.1)^3\,(0.1)$$
$$= 655000\,(0.1331)$$
$$= 87180.5$$

Q6 Find the amt after n years on ₹ 20000 @ 6% p.a CI. Also find its CI.

$\therefore CI = P\left[\left(1+\frac{R}{100}\right)^n - 1\right]$

$= 20000\left[\left(1+\frac{6}{100}\right)^4 - 1\right]$

$= 20000\left[(1.06)^4 - 1\right]$

$= 20000\left[0.26247696\right]$

$= 5249.5392$

$A = P + CI$

$A = 20000 + 5249.5392$

$A = ₹ 25249.5392$

Q7 The SI on certain sum of money for 1 year is ₹ 420 @ 7% p.a. Find the CI on the same sum @ 7% p.a for 1st year.

Ans

$SI = \frac{PNR}{100}$

$420 = \frac{P(1)(7)}{100}$

$P = \frac{420 \times 100}{7}$

$\therefore P = ₹ 6000$

$CI = P\left[\left(1+\frac{R}{100}\right)^n - 1\right]$

$= 6000\left[\left(1+\frac{7}{100}\right)^1 - 1\right]$

$= 6000\left[(1+0.07) - 1\right]$

$= 6000\,(0.07)$

$CI = 420$

Q8 At what rate of CI would an amt double itself in 3 years (Given $2^{\frac{1}{3}} = 1.2611$ approx)

Let the principal be P

$\therefore$ Amt $= 2P$

$A = P\left(1+\frac{r}{100}\right)^n$

$2P = P\left(1+\frac{r}{100}\right)^3$

$2 = \left(1+\frac{r}{100}\right)^3$

$2^{\frac{1}{3}} = \left(1+\frac{r}{100}\right)^{3 \times \frac{1}{3}}$

$1.2611 = 1 + \frac{r}{100}$

$0.2611 = \frac{r}{100}$

$r = 26.11$

Q9 At what CI rate will Rs 30 lakh earn ₹ 1081466.88 in 4 yrs.

$CI = P\left[\left(1+\frac{R}{100}\right)^n - 1\right]$

$1081466.88 = 3000000\left[\left(1+\frac{R}{100}\right)^4 - 1\right]$

$0.3604 = \left(1+\frac{R}{100}\right)^4 - 1$

$1.3604 = \left(1+\frac{R}{100}\right)^4$

$1.3605^{\frac{1}{4}} = \left(1+\frac{R}{100}\right)$

$1.08 = 1 + \frac{R}{100}$

$0.08 = \frac{R}{100}$

$R = 8\%$

Q10) The amount of ₹ 144000 at 10% PA CI rate for 3 years equals the amount of another principal sum of money @ 20% PA CI rate for 2 yrs. Find the principal sum.

$A_1 = A_2$

$P_1\left(1+\frac{R_1}{100}\right)^{n_1} = P_2\left(1+\frac{r_2}{100}\right)^{n_2}$

$144000\left(1+\frac{10}{100}\right)^3 = P_2\left(1+\frac{20}{100}\right)^2$

$144000\left(1.1\right)^3 = P_2\left(1.2\right)^2$

$144000\left(1.331\right) = P_2\left(1.44\right)$

$191664 = P_2(1.44)$

$P_2 = 1,33,100$

Half yearly

$A = P\left(1+\frac{r_2}{2\times100}\right)^{2n}$

Quaterly

$A = P\left(1+\frac{r_2}{4\times100}\right)^{4n}$

monthly

$A = P\left(1+\frac{r_2}{12\times100}\right)^{12n}$

Q11) find the amt received when a sum of ₹ 500 is invested at 12% pa for 2 years, if the interest is compounded:

i) Annually
ii) half yearly
iii) quarterly
iv) Monthly.

Sol:- given = ₹ 500
$n = 2$ years
$r = 12\%$

i) Annually:-

$A = P\left(1+\frac{r}{100}\right)^n$

$= 500\left(1+\frac{12}{100}\right)^2$

$= 500\left(1.12\right)^2$

$= 627.2$

ii) Half yearly

$A = P\left(1+\frac{r_2}{2\times100}\right)^{2n}$

$= 500\left(1+\frac{12}{200}\right)^{2\times2}$

$= 500\left(1.06\right)^4$

$= ₹\ 631.24$

iii) Quaterly

$A = P\left(1+\frac{r_2}{4\times100}\right)^{4n}$

$= 500\left(1+\frac{12}{4\times100}\right)^{4\times2}$

$= 500\left(1.03\right)^8$

$= ₹\ 633.38$

iv) Monthly

$A = P\left(1+\frac{r_2}{12\times100}\right)^{12n}$

$= 500\left(1+\frac{12}{12\times100}\right)^{12\times2}$

$= 500\left(1.01\right)^{24}$

$= ₹\ 634.87$

Annuity

Types :-

1) Annuity due.
2) ~~Annuity~~ Immediate annuity.

Perpetuity

contingency - time period not known (not before 3 yrs)

The ~~maturity~~ ~~fnt~~ (A)

1) For Annual Payments (Instalments)

$$A = P\left[\frac{\left(1+\frac{r}{100}\right)^n - 1}{\frac{r}{100}}\right]$$

where

$i = \frac{r}{100}$

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

P = principal

r = rate of int

n = no of years

Q1 Find the amt for the ordinary annuity with periodic payment as ₹ 2000, @ 12% per annum for 2 years, in each of the following cases.

1) Half yearly.
2) Yearly
3) Quarterly
4) Monthly.

Also state the capital invested.

Sol P = ₹ 2000
r = 12% p.a.
n = 2 yrs.

For Annual Instalments

$$A = P\left[\frac{\left(1+\frac{r}{100}\right)^n - 1}{\frac{r}{100}}\right]$$

$$= 2000\left[\frac{\left(1+\frac{12}{100}\right)^2 - 1}{\frac{12}{100}}\right]$$

$$= 2000\left[\frac{(1+0.12)^2 - 1}{0.12}\right]$$

$$= 2000\left[\frac{(1.12)^2 - 1}{0.12}\right]$$

$$= 2000\left[\frac{1.2544 - 1}{0.12}\right]$$

$$= 2000\left[\frac{0.2544}{0.12}\right]$$

$$= 2000\,[2.12]$$

$$= 4240$$

capital invested = 2000 × 2
= 4000

2) Halfyearly

$$A = P\left[\frac{\left(1+\frac{r}{200}\right)^{2n}-1}{\frac{r}{200}}\right]$$

$$= 2000\left[\frac{\left(1+\frac{12}{200}\right)^{2\times2}-1}{\frac{12}{200}}\right]$$

$$= 2000\left[\frac{(1+0.06)^4-1}{0.06}\right]$$

$$= 2000\left[\frac{1.2624-1}{0.06}\right]$$

$$= 2000\left[\frac{0.2624}{0.06}\right]$$

$$= 2000[4.374]$$

$$= 8749.23$$

cap. invested = $2000 \times 4 = 8000$

3) Quarterly

$$A = P\left[\frac{\left(1+\frac{r}{400}\right)^{4n}-1}{\frac{r}{400}}\right]$$

$$= 2000\left[\frac{\left(1+\frac{12}{400}\right)^{4\times2}-1}{\frac{12}{400}}\right]$$

$$= 2000\left[\frac{(1+0.03)^8-1}{0.03}\right]$$

$$= 2000\left[\frac{(1.03)^8-1}{0.03}\right]$$

$$= 2000\left[\frac{1.26677-1}{0.03}\right]$$

$$= 2000\left[\frac{0.26677}{0.03}\right]$$

$$= 2000[8.89233]$$

$$= 17,784.67$$

Cap invested = $1 \times n$

$= 2000 \times 8$

$= 16000$

4) Monthly

$$A = P\left[\frac{\left(1+\frac{r}{1200}\right)^{12\times n}-1}{\frac{r}{1200}}\right]$$

$$= 2000\left[\frac{\left(1+\frac{12}{1200}\right)^{24}-1}{\frac{12}{1200}}\right]$$

$$= 2000\left[\frac{(1.01)^{24}-1}{0.01}\right]$$

$$= 2000\left[\frac{1.2697-1}{0.01}\right]$$

$$= 2000\left[\frac{0.2697}{0.01}\right]$$

$$= 2000 \times 26.9734$$

$$= 53946.929$$

cap invested = $P \times n$

$= 2000 \times 24$

$= 48000$

Q2 How much yearly payment should be done on an ordinary annuity with dur. of 4 yrs & maturity value ₹ 69615. given that the rate @ 10% to be compound yearly.

$A = 69615$
$r = 10\%$
$n = 4$ yrs.

$$A = P\left[\frac{\left(1+\frac{r}{100}\right)^n - 1}{\frac{r}{100}}\right]$$

$$69615 = P\left[\frac{\left(1+\frac{10}{100}\right)^4 - 1}{\frac{10}{100}}\right]$$

$$= P\left[\frac{(1+0.1)^4 - 1}{0.1}\right]$$

$$= P\left[\frac{(1.1)^4 - 1}{0.1}\right]$$

$$= P\left[\frac{1.4641 - 1}{0.1}\right]$$

$$= P\left[\frac{0.4641}{0.1}\right]$$

$$69615 = P \times 4.641$$

$$P = \frac{69615}{4.641}$$

$$P = 15000$$

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

$i = \frac{r}{100}$

$$P.V = P\left[\frac{1 - \left(1 + \frac{r}{k(100)}\right)^{-kn}}{\frac{r}{k \times 100}}\right]$$

where $k = 1, 2, 4, 12$ depending on the period of annuity.

$k = 2 \Rightarrow$ half yearly.
$k = 4 \Rightarrow$ quarterly.
$k = 12 \Rightarrow$ monthly.

a) Find the present value of an annuity amt of ₹ 2000, paid at the end of each year for 4 years @ 11% comp. annually

$$P.V = \frac{P}{C}\left[1 - \frac{1}{(1+C)^n}\right]$$

$$= \frac{2000}{\frac{11}{100}}\left[1 - \frac{1}{\left(1+\frac{11}{100}\right)^4}\right]$$

$$= \frac{2000}{0.11}\left[1 - \frac{1}{(1.11)^4}\right]$$

$$= 18181.8182\left[1 - \frac{1}{1.518}\right]$$

$$= 18181.8182[1 - 0.6587]$$

$$= 18181.8182 \times 0.3412$$

$$= 6204.891$$

$$PV = P\left[\frac{1 - \left(1 + \frac{r}{k \times 100}\right)^{-kn}}{\frac{r}{k \times 100}}\right]$$ (for quarter, half yearly etc)

For an ord. annuity of ₹ 3000, per month for 1 year @ 12% to be cal. month ly.

$$P.V = P\left[\frac{1 - \left(1 + \frac{12}{12 \times 100}\right)^{-12 \times 1}}{\frac{12}{12 \times 100}}\right]$$

$$= 3000\left[\frac{1 - \left(1 + \frac{1}{100}\right)^{-12}}{\frac{1}{100}}\right]$$

$$= 3000\left[\frac{1 - (1 + 0.01)^{-12}}{0.01}\right]$$

$$= 3000\left[\frac{1 - (1.01)^{-12}}{0.01}\right]$$

$$= 3000 \times 100\left[\frac{0.01\left(1 - \frac{1}{(1.01)^{12}}\right)}{0.01}\right]$$

$$= 300000\left[\frac{1 - \frac{1}{1.12682503}}{}\right]$$

$$= 300000[1 - 0.88744923]$$

$$= 300000[0.11255077]$$

$$= 33,765.2324$$

Find the accumulated value & the P.V of an immediate annuity of ₹ 50000 P.A @ 10% P.a to be payed 4 years.

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

$$= \frac{50000}{\frac{10}{100}}\left[1 - \frac{1}{\left(1+\frac{10}{100}\right)^4}\right]$$

$$= 500000\left[1 - \frac{1}{(1.1)^4}\right]$$

$$= 500000\left[1 - \frac{1}{1.4641}\right]$$

$$= 500000\left[1 - 0.683\,01346\right]$$

$$= 500000 \times 0.3169\ 8654$$

$$= 158,493$$

Equated Monthly instalment (EMI)

1) Interest on reducing Balance Method.

$$P.V = P\left[\frac{1 - \left(1 + \frac{r}{12\times100}\right)^{-12n}}{\frac{r}{12\times100}}\right]$$

or $P.V = \frac{P(1-V^n)}{i}$

where $i = \frac{r}{100}$, $V = \frac{1}{1+i}$

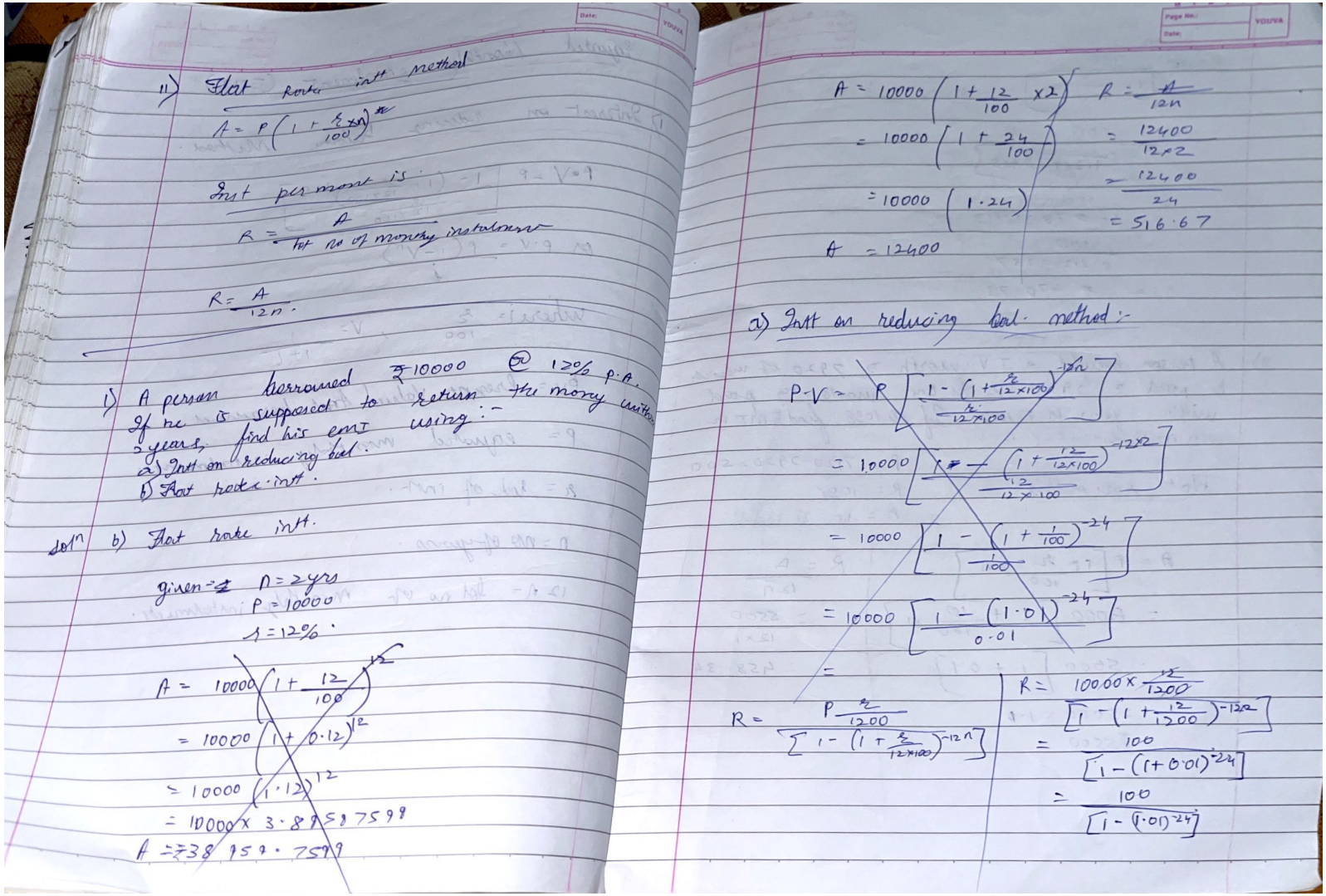
PV = Present Value / Amt borrowed.

P = equated monthly instalment.

r = Rate of int.

n = no of years.

12n = Tot no of monthly instalment.



1) Flat rate int method

$A = P\left(1 + \frac{r \times n}{100}\right)$

Inst per month is

$R = \frac{A}{\text{tot no of monthly instalments}}$

$R = \frac{A}{12n}$.

1) A person borrowed ₹10000 @ 12% p.a. If he is supposed to return the money with 2 years, find his emi using :-
a) Intt on reducing bal.
b) Flat rate intt.

soln b) Flat rate intt.

given :- $n = 2$ yrs
$P = 10000$
$r = 12\%$.

$A = 10000\left(1 + \frac{12}{100}\right)^{12}$

$= 10000\left(1 + 0.12\right)^{12}$

$= 10000\left(1.12\right)^{12}$

$= 10000 \times 3.8951759$

$A = ₹38951.7599$

$A = 10000\left(1 + \frac{12}{100} \times 2\right)$

$= 10000\left(1 + \frac{24}{100}\right)$

$= 10000\left(1.24\right)$

$A = 12400$

$R = \frac{A}{12n}$

$= \frac{12400}{12 \times 2}$

$= \frac{12400}{24}$

$= 516.67$

a) Intt on reducing bal. method :-

$P.V = R\left[\frac{1 - \left(1 + \frac{r}{12 \times 100}\right)^{-12n}}{\frac{r}{12 \times 100}}\right]$

$= 10000\left[\frac{1 - \left(1 + \frac{12}{12 \times 100}\right)^{-12 \times 2}}{\frac{12}{12 \times 100}}\right]$

$= 10000\left[\frac{1 - \left(1 + \frac{1}{100}\right)^{-24}}{\frac{1}{100}}\right]$

$= 10000\left[\frac{1 - \left(1.01\right)^{-24}}{0.01}\right]$

$= $

$R = \frac{P\frac{r}{1200}}{\left[1 - \left(1 + \frac{r}{12 \times 100}\right)^{-12n}\right]}$

$R = \frac{100.00 \times \frac{12}{1200}}{\left[1 - \left(1 + \frac{12}{1200}\right)^{-12 \times 2}\right]}$

$= \frac{100}{\left[1 - \left(1 + 0.01\right)^{-24}\right]}$

$= \frac{100}{\left[1 - \left(1.01\right)^{-24}\right]}$

$$= \frac{100}{\left[1 - \frac{1}{(1.01)^{24}}\right]}$$

$$= \frac{100}{\left\{1 - \frac{1}{1.26973465}\right\}}$$

$$= \frac{100}{1 - 0.78756613}$$

$$= \frac{100}{0.21243387}$$

$$= ₹\ 470.73$$

2) A person bought a TV worth ₹ 7920 of which he paid ₹ 2920 & the bal. was to be paid within 1 year in EMI. If @ 10%, find EMI in both methods.

Flat rate method.

$P = 7920 - 2920 = 5000$

$R = 10\%$

$n = 1$

$$A = P\left[1 + \frac{r}{100} \times n\right]$$

$$= 5000\left[1 + \frac{10}{100} \times 1\right]$$

$$= 5000\left[1 + 0.1\right]$$

$$= 5000 \times 1.1$$

$$= ₹ 5500$$

$$R = \frac{A}{12n}$$

$$= \frac{5500}{12 \times 1}$$

$$= 458.34$$

note: no of months = months

if months = months,

eg 300 months,

$12n = 300$

i) Red. bal. method

$$R = \frac{P\frac{r}{1200}}{\left[1 - \left(1 + \frac{10}{1200}\right)^{-12}\right]}$$

$$= \frac{41.6667}{1 - (1 + 0.008333)^{12}}$$

$$= \frac{41.6667}{1 - \frac{1}{(1.008333)^{12}}}$$

$$= \frac{41.6667}{\left(1 - \frac{1}{1.1047128}\right)}$$

$$= \frac{41.6667}{(1 - 0.10521279)}$$

$$= \frac{41.6667}{0.} = 439.58.$$

What is the EMI

₹	K	i
10	1 year	$\frac{₹}{100} = \frac{10}{100}$
10	K=2 (half yearly)	$\frac{₹}{2\times100} = \frac{10}{2\times100}$
10	K=4	$\frac{₹}{4\times100} = \frac{10}{100\times4}$
12	K=12	$\frac{12}{1200} = \frac{12}{1200} = \frac{1}{100}$

$$A.V/F.V = P\left[\frac{(1+i)^{kn}-1}{i}\right]$$

$$P.V = P\left[\frac{(1+i)^{kn}-1}{i\times(1+i)^{kn}}\right]$$

$$\text{loan A.V} = EMI\left[\frac{(1+i)^{kn}-1}{i\times(1+i)^{kn}}\right]$$

1) # Find the P.V & the A.V of a R.D account with periodic payment of ₹ 2500 @ 12% p.a for 2 yrs. in the full period of pay.
1) yearly
2) Half y
3) quarterly
4) Monthly.

$P = ₹2500$
$n = 2$
$r = 12$

for yearly
$i = \frac{12}{100} = 0.12$

for half.
$i = \frac{12}{2\times100} = 0.06$

for quarter $i = \frac{12}{4\times100} = 0.03$

for month $\frac{12}{12\times100} = 0.01$

A.V $= P\left[\frac{(1+i)^{kn}-1}{i}\right]$

Year $= 2500\left[\frac{(1+0.12)^2-1}{0.12}\right]$

$= 2500\left[\frac{(1.12)^2-1}{0.12}\right]$

$= \frac{2500}{0.12}\left[1.2544-1\right]$

$= 20833.33\left[1.2544\right]$

$= ₹\ 5299.99$

$= ₹\ 5300.$

1) Red. bal method

$$\text{EMI} = \frac{P\frac{R}{1200}}{\left[1-\left(1+\frac{R}{1200}\right)^{-12n}\right]}$$

$$= \frac{10000\,\frac{7}{1200}}{1-\left(1+\frac{7}{1200}\right)^{-12\times 20}}$$

$$= \left[\frac{58.333}{1-(1.0058333)^{-240}}\right]$$

$$= \frac{58.333}{1-\frac{1}{4.035834}}$$

$$= \frac{58.333}{1-0.24762343}$$

$$= \frac{58.333}{0.75237657}$$

$$= 77.5320975$$

$$= 77.53$$

2) Flat rate

$$A = P\left[1+\frac{R}{100}\times n\right]$$

$$= 10000\left[1+\frac{7}{100}\times 20\right]$$

$$= 10000\left[1+0.07\times 20\right]$$

$$= 10000\,[2.4]$$

$$= 24000$$

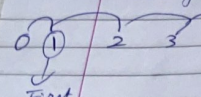
$$R = \frac{24000}{12\times 20}\times 100$$

$$R = 100$$

When the instalments of the annuity are paid in the beginning of the period it is known as annuity due.

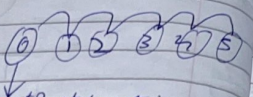
Annuity

Immediate
At the end of every period



First Instalment

Due.



1st Instalment.

beginning of the period

Let A.V (A') or future future value & P' be the present value. Let R

$$A' = P\left(1+\frac{r}{100}\right)\frac{\left[\left(1+\frac{r}{100}\right)^n - 1\right]}{\frac{r}{100}}$$

$$P' = \frac{P\left(1+\frac{r}{100}\right)}{\frac{r}{100}}\left[1-\left(1+\frac{r}{100}\right)^{-n}\right]$$

$$A' = P'\left(1+\frac{r}{100}\right)^n$$

$$\frac{1}{P'} - \frac{1}{A'} = \frac{i}{P(1+i)}$$

Find the A' & the P' of an annuity due of ₹ 8000 p.a for 3 years @ 10% p.a. also verify the relation b/w the AV & the PV.

$$P = ₹\ 8000, \quad n = 3 \quad r = 10\%$$

$$A' = P'\left(1+\frac{r}{100}\right)\frac{\left[\left(1+\frac{r}{100}\right)^n - 1\right]}{\frac{r}{100}}$$

$$= 8000\left(1+\frac{10}{100}\right)\left(\frac{\left(1+\frac{10}{100}\right)^3 - 1}{\frac{10}{100}}\right)$$

$$= 8000\,(1.1)\,\frac{(1.1)^3 - 1}{0.1}$$

$$= \$\ 8000 \times 0.331$$

$$= RS\ 29128$$

Sums for revision.

1) The SI @ 6% on ₹ 60000 for 6 yrs is ——
2) The SI @ 8% for a fixed deposit at the end of 4 yrs was ₹ 640, the principle for the F.D was ——
3) At what rate a principal of ₹ 4000 be p for 3 yrs so that as to get ₹ 1320 as SI.
4) A bank promises to double the principle invested by their customers in 10 yrs what is the rate of int offered by the bank.