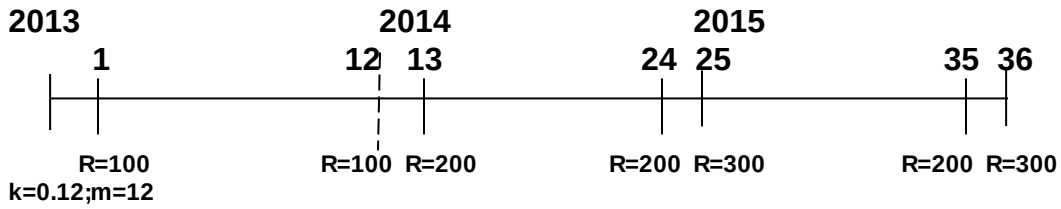
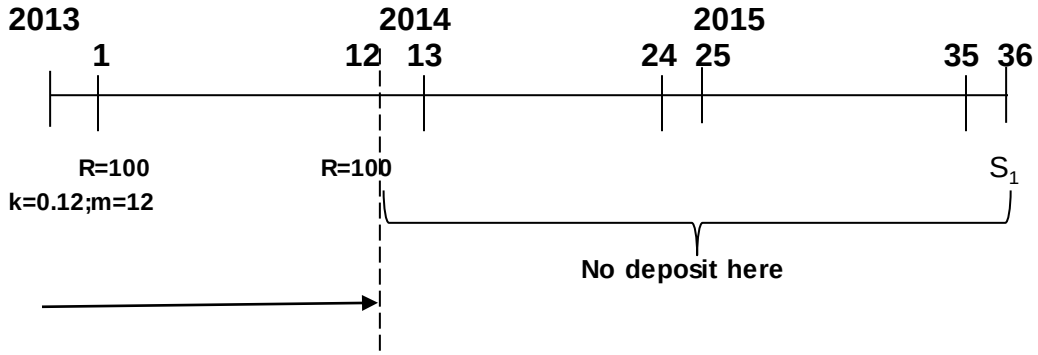
TUTORIAL : ANNUITY (Answer Scheme)

1) Table below shows the monthly deposits that were made into an investment account that pays 12% compounded monthly. Find the value of this investment at the end of 2015. (8 marks)

Year	Monthly deposit
2013	RM100
2014	RM200
2015	RM300



Stream I:



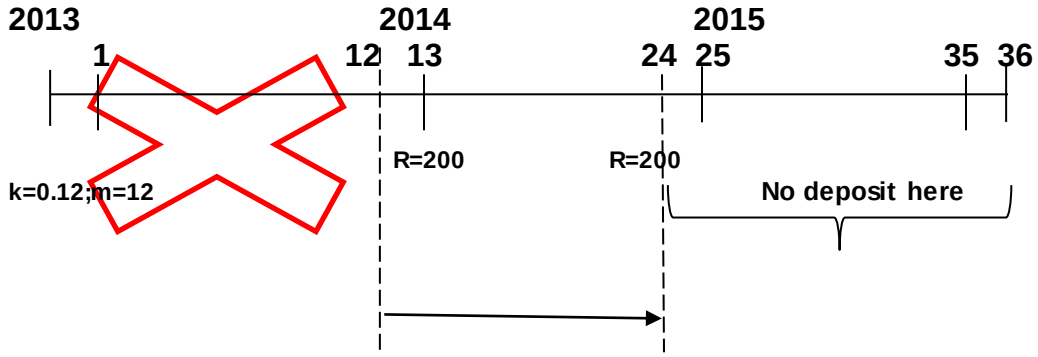
The first year:

$$S = R\left[\frac{(1+i)^n - 1}{i}\right] = 100\left[\frac{(1+0.01)^{12} - 1}{0.01}\right] = RM1{,}268.25$$

The next 2 year:

$$S_1 = P(1+i)^n = RM1{,}268.25(1+0.01)^{24} = RM1{,}610.34$$

Stream II:



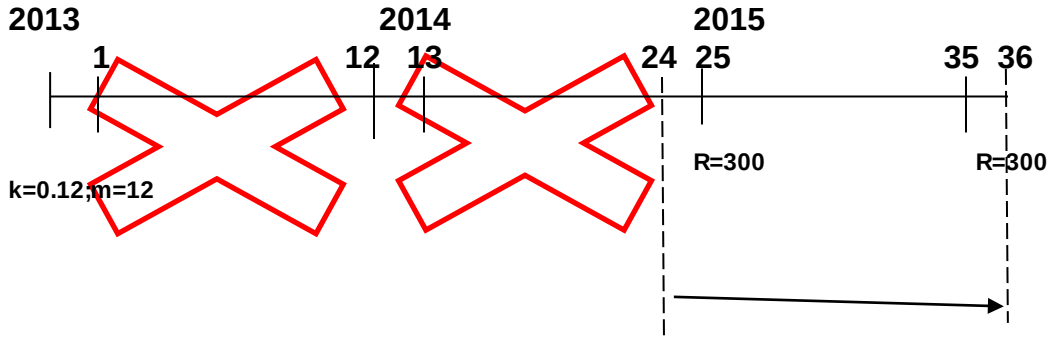
End of 2015:

$$S = R\left[\frac{(1+i)^n - 1}{i}\right] = 200\left[\frac{(1+0.01)^{12} - 1}{0.01}\right] = \text{RM}2{,}536.50$$

The next 2 year:

$$S_2 = P(1+i)^n = \text{RM}2{,}536.50(1+0.01)^{12} = \text{RM}2{,}858.19$$

Stream III:



Year 2015:

$$S_3 = R\left[\frac{(1+i)^n - 1}{i}\right] = 300\left[\frac{(1+0.01)^{12} - 1}{0.01}\right] = \text{RM}3{,}804.75$$

The value of investment, S = $S_1 + S_2 + S_3 = \text{RM}8{,}273.28$

If the question asked for amount of interest,

$$I = S - nR = \text{RM}8{,}273.28 - [12(100) + 12(200) + 12(300)] = \text{RM}1{,}073.28$$

2) Razif borrowed RM70,000 form a bank for 5 years at 6% compounded monthly

i) Find the monthly payment (3 marks)

A=RM70,000
k=0.06; m=12

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

$$70{,}000 = R\left[\frac{1-\left(1+\frac{0.06}{12}\right)^{-60}}{\frac{0.06}{12}}\right]$$

$$RM1{,}353.30 = R$$

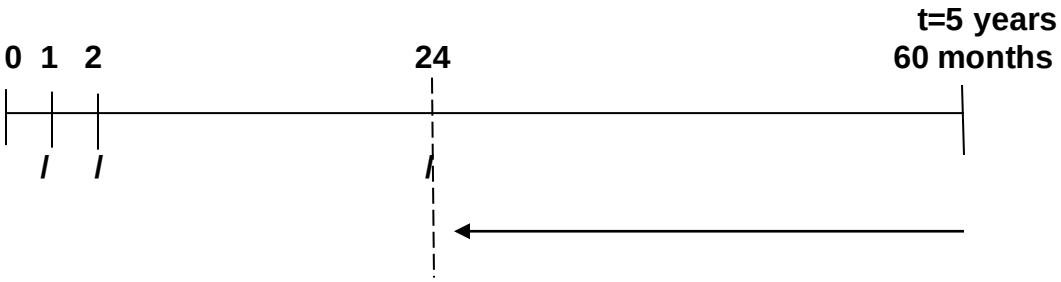
ii) If he has not paid his first 3 monthly payments, how much should he pay on the 4th payment to settle all the outstanding arrears? (3 marks)

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

$$= RM1{,}353.30\left[\frac{\left(1+\frac{0.06}{12}\right)^{4}-1}{\frac{0.06}{12}}\right]$$

$$= RM5{,}453.93$$

iii) Immediately after paying the 24th monthly payment, he wants to settle the balance of the debt with a single payment. How much should this payment be? (3 marks)



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

$$= 1{,}353.30\left[\frac{1-\left(1+\frac{0.06}{12}\right)^{-36}}{\frac{0.06}{12}}\right]$$

$$A = \text{RM}44{,}484.35$$

3) **Malinda bought a terrace house for RM185,000. She paid a 10% down payment and the balance was borrowed form a bank that charged interest at the rate of 3.5% compounded monthly. This loan would be paid in monthly installments for 10 years. Find**

i) The monthly payment **(3 marks)**

A=RM185,000-(0.1x185,000)
=RM166,500
k=0.035; m=12

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

$$166{,}500 = R\left[\frac{1-\left(1+\frac{0.035}{12}\right)^{-120}}{\frac{0.035}{12}}\right]$$

$$RM1{,}646.45 = R$$

ii) The total interest charged **(2 marks)**

$$I = nR - A$$
$$= 120(RM1{,}646.45) - 166{,}500$$
$$= RM31{,}074$$

4) Luqman took a loan from First Nasional Bank that charged interest of 4% compounded monthly. He has to pay RM1,000 each month for 15 years to settle the loan.

i) Find the amount of the loan. (3 marks)

t=15 years

A=?

k=0.04; m=12

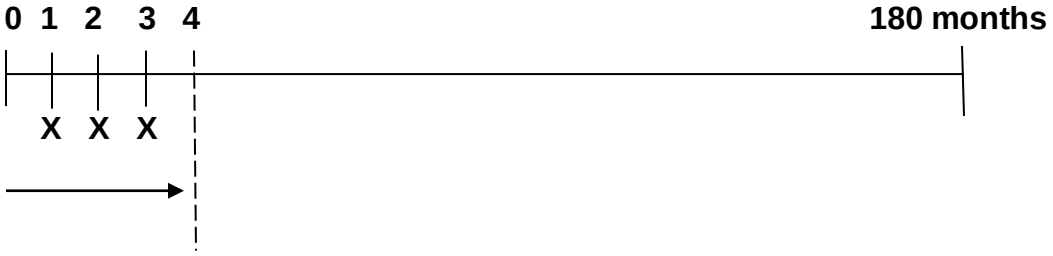
$$A = R\left[\frac{1-(1+i)^{-n}}{i}\right]$$

$$= 1{,}000\left[\frac{1-\left(1+\frac{0.04}{12}\right)^{-180}}{\frac{0.04}{12}}\right]$$

$$= \text{RM}135{,}192.15$$

ii) If Luqman failed to pay the first 3 monthly payments, find the amount he has to pay on the 4th payment in order to settle the outstanding payments. (3 marks)

t=15years



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

$$= \text{RM}1{,}000\left[\frac{\left(1+\frac{0.04}{12}\right)^{4}-1}{\frac{0.04}{12}}\right]$$

$$= \text{RM}4{,}020.04$$

5) **The cash price of an apartment is RM80,000. Suhaimi bought the apartment through an installment plan for 12 ½ years and the interest rate charged was 8% compounded monthly.**

i) Find the equal monthly installment. (3 marks)

A=RM80,000

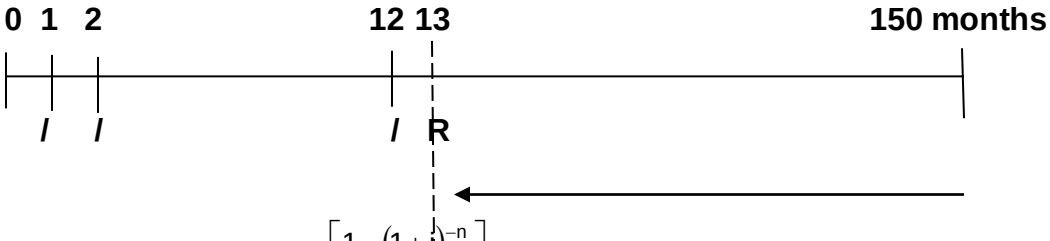
k=0.08; m=12

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

$$80{,}000 = R\left[\frac{1-\left(1+\frac{0.08}{12}\right)^{-150}}{\frac{0.08}{12}}\right]$$

$$RM845.36 = R$$

ii) After paying 1 year, Suhaimi decide to settle all the outstanding balance. Find the amount Suhaimi had to pay on the 13th payment. What is the total interest charged?



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

$$= 845.36 + 845.36\left[\frac{1-\left(1+\frac{0.08}{12}\right)^{-137}}{\frac{0.08}{12}}\right]$$

$$= \text{RM}76{,}623.11$$

6) Daus plans to buy a house that costs RM180,000. He can afford to pay 10% as a down payment. The balance must be financed by Suci Bank that charges an interest rate of 8.64% compounded monthly. Daus agrees to pay the loan in monthly installments for 15 years.

i) How much is Daus's monthly installment?

A=RM180,000-(0.1xRM180,000)
=RM162,000
k=0.0864; m=12

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

$$162{,}000 = R\left[\frac{1-\left(1+\frac{0.0864}{12}\right)^{-180}}{\frac{0.0864}{12}}\right]$$

$$\text{RM}1{,}608.60 = R$$

ii) How much did Daus actually pay for the house?

$$\begin{aligned}\text{Amount paid} &= nR + DP \\ &= 180(1{,}608.60) + 18{,}000 \\ &= RM\,307{,}548\end{aligned}$$

OR

$$\begin{aligned}\text{Amount paid} &= CP + I \\ &= 180{,}000 + [180(1{,}608.60) - 162{,}000] \\ &= RM\,307{,}548\end{aligned}$$

iii) Calculate the total interest that is charged to Daus.

$$\begin{aligned}I &= nR - A \\ &= 180(1{,}608.60) - 162{,}000 \\ &= RM\,127{,}548\end{aligned}$$