Time Value of Money

Select Exercises

Select Formulas

(do refer a standard text book on the subject for more relevant formulas)

- Future value:

$$F_n = P(1+i)^n$$

- If compounding is done, more than once a year:

$$F_n = P\left(1+\frac{i}{m}\right)^{mn}$$

- Converting nominal interest rate (i) to effective interest rate:

$$\text{EIR} = \left[1+\frac{i}{m}\right]^{n\times m} - 1$$

- Continuous compounding:

$$F_n = P * e^{n*i}$$

- Present value:

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

- Future value of an annuity (FVIFA):

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

- Present value of an annuity (PVIFA):

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

Select Formulas, contd..

- Present value of an annuity with constant growth:

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

- Present value of perpetuity :

$$P = \frac{A}{i}$$

- Present value of perpetuity with constant growth:

$$P = \frac{A}{i-g}$$

- Future value of an annuity due:

$$F_n = A * FVIFA * (1+i)$$

- Present value of an annuity due:

$$P = A * PVIFA * (1+i)$$

1. What will be the realization at the end of 10^{th} year, if Rs.10,000 is invested today when interest rate is 12%?
   a. Interest payable annually
   b. Interest payable semiannually
   c. Interest payable monthly
   d. Interest payable daily
   e. Interest payable continuously
2. Suppose you are going to receive an annuity of Rs.5,000 for seven years starting after three years from today? What will be the equivalent amount you would like to receive today? Your expected rate of return is 10%.

3. Suppose an investment offers Rs.5,000 p.a. for 4 years starting this year end and Rs.7,000 for another 6 years from 5^{th} year end onwards. How much would you like to pay for it today, when expected rate of return is 8%?
4. Mr. Kitta is planning to save for retirement over the next 30 years. To do this, he will invest Rs.7000 a month in a stock account and Rs.3,000 a month in a bond account. The return of the stock account is expected to be 11 percent, and the bond account will pay 7 percent. When he retires, he will combine the money into an account with a 9 percent return. How much he can withdraw each month from the account assuming a 25-year withdrawal period?

5. What is the effective annual rate (EAR) when annual percentage rate (APR) rate is 11% and compounding done quarterly?
6. What is the effective annual rate (EAR) when annual percentage rate (APR) rate is 7% and compounding done monthly?
7. You have just purchased a new warehouse. To finance the purchase, you've arranged for a 30-year mortgage for 80 percent of the Rs.16 lakh purchase price. The monthly payment on this loan will be Rs.10,000. what is the APR on this loan? The EAR?

8. Mr. Harry's job pays only once a year for all the work he did over the previous 12 months. Today, December 31, Mr. Harry received salary of Rs.50,000, and he plans to spend all of it. However, he wants to start saving for retirement beginning next year. He has decided that one year from today he will begin depositing 2 percent of his annual salary in an account that will earn 8 percent per year. His salary will increase at 4 percent per year throughout his career. How much money will he have on the date of his retirement 40 years from today?

9. Suppose Mr. Peak borrows Rs.10 lakh today from a bank and it has to be repaid in 5 annual equal installments starting this year end. If the interest rate is 10%, what is the annual installment amount? What will be the interest and principal portion each year for the installment amount?
10. In the above exercise, if the installment is paid monthly, what will be the amount [EMI]?
11. Refer to exercise # 9, if the installment payment starts today, what will be the installment amount?

12. Your financial planner offers you two different investment plans. Plan X is a Rs.10,000 annual perpetuity. Plan Y is a 10-year, Rs.22,000 annual annuity. Both plans will make their first payment one year from today. At what discount rate would you be indifferent between these two plans?

Reference: Exercises adapted from **Corporate Finance**, 8e, by Ross and Kakani, Tata McGraw Hill