Tutorial – Time value of money

1. What is the time value of money? Why does money have time value?

2. The relationship between the frequency of compounding and effective annual rate?

3. If you invest $1,000 today at an interest rate of 10%/year, how much will you have 20 years from now assuming no withdrawals in the interim?

4. You have just discovered that there are 100 million VND in your bank account. You are so scared of money laundering, but the bank said that 20 years ago, your father deposited an amount of money into your account, earning 8% interest per year. What was that amount? Would you have 120million VND to establish a company two years from now after graduating?

5. It is your 21st birthday and you receive an IOU that promises to pay you 10 million VNDs five years from now. How much is it worth if the discount rate is 10% per annum?

6. You are 20 years old and are considering putting 1million VNDs into an account paying 7.5% per year with annually compounding for 45 years.

a. How much will you have in the account at age 65? Assuming you take nothing out of the account before then. How much of it will be simple interest, and how much compound interest?

b. If you could find an account paying 8% per annum, how much more would you have at age 65? Offer your comments.

7. If you invest $100 every year for the next 20 years starting one year from now and you earn interest of 10% per year, how much will you have at the end of the 20 years? How much must you invest each year if you want to have $50,000 at the end of the 20 years?

8. If you borrow $100,000 from a bank for 30 years at an APR of 13%, monthly payment, what will EAR be?

9. What is the present value of the following cash flows at the interest rate of 10%/year?

a. $100 received 5 years from now.

b. $100 received 60 years from now.

c. $100 received each year beginning one year from now and ending 10 years from now.

d. $100 received each year for 10 years beginning now.

e. $100 each year beginning one year from now and continuing forever.

10. How much is the value of your 12% bank account on 01/01/2026 if you put $100 into it on 01/01/2022, $200 on 01/01/2023, $300 on 01/01/2024?

11. If you put $1,000 into your 14% bank account on 01/01/2020 $2,000 on 01/01/2021, and $3,000 on 01/01/2022, when will you get $12,668.46?

12. You must pay a creditor $8,000 one year from now, $5,000 two years from now, $4,000 three years from now, $2,000 four years from now. You would like to restructure the loan into four equal annual payments due *at the end of each year*. If the agreed interest rate is 12% compounded annually, what is the payment?

13. You have just received a gift of $500 from your grandmother and you are thinking about saving this money for graduation which is 4 years away. You have your choice between Bank

A, which is paying 7% for one – year deposits (compound interest annually) and Bank B which is paying 6% per year (compound every three months). What is the future value of your savings one year from today, 4 years from today if you save your money in Bank A? Bank B? Which is the better decision?

14. Lai's great aunt left him $20,000 when she died. He can invest the money to earn 12% per year. If he spends $3,540 per year out of this inheritance, how long will the money last?

15. What's the rate of return you would earn if you paid $1,500 for a perpetuity that pays $105 per year?

16. What's the present value of a perpetuity that pays $100 per year if the appropriate interest rate is 6%?

17. Kathy's rich uncle promises her an allowance of $10,000 per month, starting today, with a final payment to be made 6 months today. If the interest rate is 0.5 per cent per month, what is the present value of the promised allowance?

18. Mai has three personal loans outstanding to her friend. A payment of $1,000 is due today, a $500 payment is due one year from now and a $250 payment is due two years from now. She would like to consolidate the three loans into one, with thirty – six equal monthly payments, beginning one month from today. Assume the agreed effective annual rate is 8% per year. How large will the new monthly payment be?

19. A local bank advertises the following deal: "Pay us $100 a year for 10 years and then we will pay you (or your beneficiaries) $100 a year forever". Is this a good deal if the interest rate available on other deposit is 6%?

20. A local bank will pay you $100 a year for your lifetime if you deposit $2,500 in the bank today. If you plan to live forever, what interest rate is the bank paying?

21. At retirement nine years from now, a client will have the option of receiving a lump sum of $400,000 or 20 annual payments of $40,000, with the first payment made at retirement. What is the annual rate the client would need to earn on a retirement investment to be indifferent between the two choices?

22. Your parents have deposited $500 into a savings account since you were born. Every following year on your birthday your parents have been putting in an additional amount which is 10% higher than the last deposit. The interest rate on the account is 5%, compounded annually. How much money will be in the account on your 20^{th} birthday immediately before your parents make the deposit on that day?

23. You just won the lottery. Moreover, you live in a world in which you know that there will never be any taxes or inflation. The lottery sponsors have offered you your choice of two prizes. You may choose to receive either $100,000 today or a stream of 15 equal annual payments of $30,000, with the first payment to be received exactly 12 years from today. Whichever prize you choose, you are certain to receive the promised payment(s); there is no risk. Which prize should you choose? Assume that you can earn 10% interest per year, compounded annually.

Tutorial – Time value of money- Applications

24. An investor is looking at a $150,000 house. If 20% must be paid down and the balance is financed at 12% over the next 30 years. What is the annual mortgage payment?

25. An investor is looking at a $150,000 house. If 20% must be paid down and the balance is financed at APR 12% over the next 30 years. What is the monthly mortgage payment?

26. Calculate the net present value of the following cash flows: you invest $2,000 today and receive $200 one year from now, $980 two years from now and $ 1200 a year for two years starting three years from now. Assume that the interest rate is 14% per year. Give your comments on your investment.

27. You are taking out a $100,000 mortgage loan to be repaid over 25 years in 300 monthly payments.

a. If the APR is 16%/year, what is the amount of the monthly payment?

b. If you can only afford to pay $1,000 per month, how large a loan could you take?

c. If you can afford to pay $1,500 per month and need to borrow $100,000, how many months would it take to pay off the mortgage?

d. If you can afford to pay $1,500 per month and need to borrow $100,000, and want a 25 – year mortgage, what is the highest interest rate you can pay?

28. P&G company has 2 billion VND to invest. Should it invest in which projects among following projects:

Unit: Million VND

	Original cost	Year 1		Year 2		Year 3	
		Revenue	Cost	Revenue	Cost	Revenue	Cost
Project 1	900	800	500	1,000	500	1,200	600
Project 2	500	300	100	300	150	500	200
Project 3	1,200	1,200	600	1,200	600	1,200	600
Project 4	600	500	200	600	250	800	350

Opportunity cost of capital is 10% per year.

29. Suppose you are considering borrowing 2 billion VND to finance your dream house. The annual interest rate is 9%.

a. If the mortgage has a 30 – year amortization schedule, what are the annual payments?

b. If the payments are made monthly at the same APR, what are the monthly payments? What EAR would you be paying for?

c. How do your answers to part a and b change if the loan amortizes over 15 years rather than 30 years?

30. When you purchased a house, you took out a $500,000, 30-year annual-payment mortgage with an interest rate of 6% per year. You have now decided to pay the mortgage off by repaying the outstanding balance. Calculate the annual payment.

What is the payoff amount if:

a. You decided to pay off the mortgage immediately after the 12^{th} payment is made.

b. You decided to pay off the mortgage immediately before the 12^{th} payment is due.

31. Following up Q20.

a. How much is total interest that you paid before the payment in (a) and (b)?

b. What is the total amount of interest paid within the 13th year if you have not paid the mortgage off?

32. A client has $202,971.39 in an account that earns 8% per year, compounded monthly. The client's 24^{th} birthday was yesterday, and she will retire when the account value is $1 million.

a. At what age can she retire if she doesn't put more money in the account?

b. At what age can she retire if she puts $250 per month into the account every month, beginning one month from today?