

## TIME VALUE OF MONEY

### (PRESENT WORTH AND FUTURE WORTH METHOD)

1. How much must be invested now at 16% compounded annually so that \$1,811 can be received 4 years hence?
2. Suppose you buy a share of stock for \$20 and sell it for \$40. If this happens within a year then your  $i = 100\%$ . If it takes 5 years, what is the rate of return on your investment?
3. "Now", is June 30, 1994. Three payments of \$500 each are to be received every 2 years, starting 2 years from now and deposited where they will earn interest at 7% per year. How large will the bank account be on June 30, 2002?
4. You just purchased 100 shares of Citi group stock at \$60/ share. You will sell the stock when market price is doubled. If you expect the stock price to increase 20% per year, how long do you anticipate waiting before selling the stock?
5. Wilson technology, wishes to set aside money now to invest over the next 4 years to use to automate its customer service department. The company can earn an interest at 10% on the lump sum deposited now and it wishes to withdraw the money in the following increments.
  - Year 1: \$25,000 to purchase a computer
  - Year 2: \$3000 to purchase additional hardware
  - Year 3: No expenses
  - Year 4: \$5000 to purchase s/w upgrades.

How much money must be deposited now to cover anticipated expenses over next 4 years?

6. Suppose that you have a savings plan covering the next ten years, according to which you put aside \$600 today, \$800 at the end of every year for the next five years, and \$2000 at the end of each year for the remaining five years. As part of this plan, you expect to withdraw \$300 at the end of every year for the first 3 years, and \$350 at the end of every year thereafter till the 10<sup>th</sup> year. In addition to this you are expected to withdraw an amount of \$50 at the end of every 2 years till 15<sup>th</sup> year. Assume interest to be 12%.
  - i) Draw your cash flow diagram.
  - ii) Find the amount accumulated in the saving account at the end of 15th year.

### (ANNUAL WORTH METHOD)

7. With interest of 6%, what is the worth on December 31<sup>st</sup>, 1994, of a series of end payments of \$317.70 made from years 2000 through 2004?
8. Suppose you make an annual contribution of \$3000 to your savings account at the end of each year for 10 years. If the account earns 7% interest annually, how much can be withdrawn at the end of 10 years? Suppose the ten deposits were made at the beginning of each period, what is the balance at the end of period 10?
9. A person plans to have a retirement policy which will give him return when he reaches an age of 50. For this person whose age is 35 years now has to make annual premium payment of Rs. 19760 till he reaches an age of 49. if the interest rate is 8% compounded annually, what is the lump sum he is getting a maturity for this policy.
10. Consider 3 investment plans for an individual who just celebrated his 24<sup>th</sup> birthday. ( $i = 8\%$ )
  - I. Invest \$2000 per year for first 10 years. At the end of 10 years make no further investments, but reinvest the amount for next 30 years.
  - II. Do nothing for first 10 years. Then start investing \$2000/year for the next 30 years.
  - III. Invest \$2000/ year for the entire 40 years.Note that all investments are made at the birthday of each year, the first deposit will be made on 25<sup>th</sup> birthday ( $n=1$ ). Calculate the balance as on 64<sup>th</sup> birthday ( $n=40$ )
11. Biogen Co., has borrowed \$250,000 to purchase lab equipment for gene splicing at an interest rate of 8% and is to be repaid in equal instalments over next 6years.

- I. Compute the annual instalment.
  - II. Suppose Bio Gen wants to negotiate with the bank to defer the first loan payment until the end of year 2 (but still desires to pay the 6 instalments at 8% interest) What should be the annual instalment (deferred annuity)
12. You plan to retire 33 years from now. You expect that you will live 27 years after retiring. You want to have enough money upon reaching retirement age to withdraw Rs. 1,80,000 from the account at the beginning of each year you expect to live, and yet still have Rs. 25,00,000 left in the account at the time of your expected death (60 years from now). You plan to accumulate the retirement fund by making equal annual deposits at the end of each year for the next 33 years. You expect that you will be able to earn 12% per year on your own deposits. However, you only expect to earn 6% per year on your investment after you retire since you will choose to place the money in less risky investments. What equal annual deposits must you make each year to reach your retirement goal?
  13. How much money will be accumulated in 25 years if Rs. 800 is deposited at the end of 2nd year from now, Rs. 2400 six years from now and Rs. 3300 eight years from now all at an interest rate of 18% per year. Also, find its equivalent annual worth (A) for this time period of 25 years.
  14. A couple with a new born daughter wants to save for their child's college expenses in advance. The couple can establish a college fund that pays 7% annual interest. Assuming the child enters college at age 18, the parents estimate that an amount of \$40,000 per year will be required to support the child's college expenses for 4 years. Determine the equal annual amounts the couple must save until they send their child to college. (Assume the first deposit will be made on the child's first birthday and the last deposit on the child's 18<sup>th</sup> birthday. The first withdrawal will be made at the child's 18<sup>th</sup> birthday.
  15. A boy is now 11 years old. On his fifth birthday he received a gift of \$5,000 from his grandparents, which was invested in a 10 year fixed deposit bearing an interest rate of 6% per year compounded annually. His parents plan to have \$6,000 available each year for the boy's nineteenth to twenty second birthdays to help finance his college education. To assist the financing, the fixed deposit will be reinvested when it matures. If required how much equal amount should the parents deposit each year, beginning from his next birthday, so that one year after the last deposit they can start making payments to their son. All future investments will earn 6.5% per year compounded annually. (Change in interest rate numerical)

#### **(GRADIENT SERIES):**

16. A textile mill has just purchased a lift truck that has a useful life of 5 years. The engineer estimates that the maintenance costs for the truck during the first year will be \$1000. As the truck ages, the maintenance costs are expected to increase at a rate of \$250 per year over the remaining life. The firm wants to set up a maintenance account that earns 12% annual interest. All future maintenance expenses will be paid out of this account. How much does the firm have to deposit in the account now?
17. Suppose that you make a series of annual deposits into a bank account that pays 10% interest. The initial deposit at the end of 1<sup>st</sup> year is \$1,200. The deposit amounts decline by \$200 in each of the next 4 years. How much would you have immediately after the fifth deposit?
18. John and Barbara have just opened 2 savings accounts at their bank. John wants to deposit \$1000 in his account at the end of the first year and increase the amount by \$300 for each of the next 5 years. Barbara wants to deposit an equal amount each year for next 6 years. What should be Barbara's annual deposit so that the two accounts will have equal balances at the end of 6 years?  $i = 10\%$

#### **(NOMINAL AND EFFECTIVE INTEREST RATES)**

19. Suppose you make equal quarterly deposits of \$1500 into a fund that pays interest at a rate of 6% compounded monthly. Find the balance at the end of year 2.
20. Suppose you make \$500 monthly deposits to a retirement plan that pays interest at a rate of 10% compounded quarterly. Compute the balance at the end of 10 years.

21. Suppose your savings account pays 9% interest compounded quarterly. If you deposit \$10,000 for one year, how much would you have?
22. A loan company offers money at 1.8% per month, compounded monthly.
  - (a) What is the nominal interest rate?
  - (b) What is the effective annual interest rate?
  - (c) How many years will it take an investment to triple if interest is compounded monthly?
23. What is the present worth of the following series of payments?
  - (a) \$1,500 at the end of each six-month period for 12 years at 8% compounded semi-annually.
  - (b) \$2,500 at the end of each quarter for 8 years at 8% compounded quarterly.
24. You borrowed \$15,000 for buying a new car from a bank at an interest rate of 12% compounded monthly. This loan will be repaid in 48 equal monthly instalments over four years. Immediately after the 20th payment, you desire to pay the remainder of the loan in a single payment. Compute this lump-sum amount of that time.
25. A couple is planning to finance its three-year-old son's college education. Money can be deposited at 6% compounded quarterly. What quarterly deposit must be made from the son's 3rd birthday to his 18th birthday to provide \$50,000 on each birthday from the 18th to the 21st? (Note that the last deposit is made on the date of the first withdrawal.)
26. Georgi Rostov deposits \$5000 for the three years (starting from now) in a savings account that pays a 6% interest compounded monthly. At the end of the sixth year, he deposits \$4000. Two years after the \$4000 deposit, he makes another two equal deposits, amount of \$2500 semi-annually. Six years after the previous deposit, half of the accumulated fund is transferred to a fund that pays 8% interest compounded quarterly. How much money will be accumulated in each account one year after this transfer?
27. An amount of 1200 per year is to be paid into an account each for the next five years. Using an interest rate of 12 % determine the total amount the account will have at the end of 5<sup>th</sup> year. Deposit made at the end of each year with interest compounded monthly.
28. A couple would like to determine what amount they must deposit in a savings account bearing 12% interest rate so that they will get Rs.5000/- at the end of 10th year and will get an increase of Rs.1000/- each year for the next 10 years. Draw the cash flow diagram.
  - i) Determine the present amount.
  - ii) If the interest rate is compounded quarterly what is the present amount?
29. Visteon, a spin-off company of Ford Motor Company, supplies major automobile components to auto manufacturers worldwide and is Ford's largest supplier. An engineer is on a Visteon committee to evaluate bids for new-generation coordinate-measuring machinery to be directly linked to the automated manufacturing of high-precision components. Three vendor bids include the interest rates. Visteon will make payments on a semi-annual basis only. The engineer is confused about the effective interest rates. What they are annually and over the payment period (PP) of 6-months.
 

Bid 1: 9% per year, compounded quarterly

Bid 2: 3% per quarter, compounded quarterly

Bid 3: 8.8% per year, compounded monthly

  - i) Determine the effective rate for each bid on the basis of semi-annual payments, and construct cash flow diagrams for each bid rate.
  - ii) What are the effective annual rates? These are to be a part of the final bid selection.
  - iii) Which bid has the lowest effective annual rate?
30. A company is planning to invest Rs. 6000 once in 6 months; the investment is made at the end of every 6th month, for next 5 years. The company is planning to utilize this amount accumulated at the end of 5<sup>th</sup> year for buying an asset. Identify the amount accumulated at the end of 5<sup>th</sup> year under following cases:
  - i) If interest is 12% compounded semi-annually. (Ans- )
  - ii) If interest is 12% compounded annually. (Ans- )
  - iii) If interest is 12% compounded quarterly. (Ans- )

31. Krishna deposits \$18,000 in a savings account that pays 8% interest compounded monthly. Three years later, he deposits \$10,000. Two years after the \$10,000 deposit, he makes another deposit in the amount of \$15,500. Four years after the \$15,500 deposit, half of the accumulated funds is transferred to a fund that pays 10% interest compounded quarterly. How much money will be in each account six years after the transfer?
32. A series of ten quarterly payments of \$1500 at the rate of 12 percent per annum compounded quarterly is equivalent to three semi-annual withdrawals from the third year. What is the amount of these three payments? If the three withdrawals are annual from the fourth year, recalculate the amount.