

CHAPTER 6

TIME VALUE OF MONEY

(Difficulty: E = Easy, M = Medium, and T = Tough)

Multiple Choice: Conceptual

Easy:

PV and discount rate

Answer: a Diff: E

1. You have determined the profitability of a planned project by finding the present value of all the cash flows from that project. Which of the following would cause the project to look more appealing in terms of the present value of those cash flows?
- a. The discount rate decreases.
 - b. The cash flows are extended over a longer period of time, but the total amount of the cash flows remains the same.
 - c. The discount rate increases.
 - d. Statements b and c are correct.
 - e. Statements a and b are correct.

Time value concepts

Answer: e Diff: E

2. Which of the following statements is most correct?
- a. A 5-year \$100 annuity due will have a higher present value than a 5-year \$100 ordinary annuity.
 - b. A 15-year mortgage will have larger monthly payments than a 30-year mortgage of the same amount and same interest rate.
 - c. If an investment pays 10 percent interest compounded annually, its effective rate will also be 10 percent.
 - d. Statements a and c are correct.
 - e. All of the statements above are correct.

Time value concepts

Answer: d Diff: E

3. The future value of a lump sum at the end of five years is \$1,000. The nominal interest rate is 10 percent and interest is compounded semiannually. Which of the following statements is most correct?
- a. The present value of the \$1,000 is greater if interest is compounded monthly rather than semiannually.
 - b. The effective annual rate is greater than 10 percent.
 - c. The periodic interest rate is 5 percent.
 - d. Statements b and c are correct.
 - e. All of the statements above are correct.

Time value concepts**Answer: d Diff: E**

4. Which of the following statements is most correct?
- a. The present value of an annuity due will exceed the present value of an ordinary annuity (assuming all else equal).
 - b. The future value of an annuity due will exceed the future value of an ordinary annuity (assuming all else equal).
 - c. The nominal interest rate will always be greater than or equal to the effective annual interest rate.
 - d. Statements a and b are correct.
 - e. All of the statements above are correct.

Time value concepts**Answer: e Diff: E**

5. Which of the following investments will have the highest future value at the end of 5 years? Assume that the effective annual rate for all investments is the same.
- a. A pays \$50 at the end of every 6-month period for the next 5 years (a total of 10 payments).
 - b. B pays \$50 at the beginning of every 6-month period for the next 5 years (a total of 10 payments).
 - c. C pays \$500 at the end of 5 years (a total of one payment).
 - d. D pays \$100 at the end of every year for the next 5 years (a total of 5 payments).
 - e. E pays \$100 at the beginning of every year for the next 5 years (a total of 5 payments).

Effective annual rate**Answer: b Diff: E**

6. Which of the following bank accounts has the highest effective annual return?
- a. An account that pays 10 percent nominal interest with monthly compounding.
 - b. An account that pays 10 percent nominal interest with daily compounding.
 - c. An account that pays 10 percent nominal interest with annual compounding.
 - d. An account that pays 9 percent nominal interest with daily compounding.
 - e. All of the investments above have the same effective annual return.

Effective annual rate**Answer: d Diff: E**

7. You are interested in investing your money in a bank account. Which of the following banks provides you with the highest effective rate of interest?
- a. Bank 1; 8 percent with monthly compounding.
 - b. Bank 2; 8 percent with annual compounding.
 - c. Bank 3; 8 percent with quarterly compounding.
 - d. Bank 4; 8 percent with daily (365-day) compounding.
 - e. Bank 5; 7.8 percent with annual compounding.

Amortization**Answer: b Diff: E**

8. Your family recently obtained a 30-year (360-month) \$100,000 fixed-rate mortgage. Which of the following statements is most correct? (Ignore all taxes and transactions costs.)
- a. The remaining balance after three years will be \$100,000 less the total amount of interest paid during the first 36 months.
 - b. The proportion of the monthly payment that goes towards repayment of principal will be higher 10 years from now than it will be this year.
 - c. The monthly payment on the mortgage will steadily decline over time.
 - d. All of the statements above are correct.
 - e. None of the statements above is correct.

Amortization**Answer: e Diff: E**

9. Frank Lewis has a 30-year, \$100,000 mortgage with a nominal interest rate of 10 percent and monthly compounding. Which of the following statements regarding his mortgage is most correct?
- a. The monthly payments will decline over time.
 - b. The proportion of the monthly payment that represents interest will be lower for the last payment than for the first payment on the loan.
 - c. The total dollar amount of principal being paid off each month gets larger as the loan approaches maturity.
 - d. Statements a and c are correct.
 - e. Statements b and c are correct.

Quarterly compounding**Answer: e Diff: E**

10. Your bank account pays an 8 percent nominal rate of interest. The interest is compounded quarterly. Which of the following statements is most correct?
- a. The periodic rate of interest is 2 percent and the effective rate of interest is 4 percent.
 - b. The periodic rate of interest is 8 percent and the effective rate of interest is greater than 8 percent.
 - c. The periodic rate of interest is 4 percent and the effective rate of interest is 8 percent.
 - d. The periodic rate of interest is 8 percent and the effective rate of interest is 8 percent.
 - e. The periodic rate of interest is 2 percent and the effective rate of interest is greater than 8 percent.

Medium:

Annuities

Answer: c Diff: M

11. Suppose someone offered you the choice of two equally risky annuities, each paying \$10,000 per year for five years. One is an ordinary (or deferred) annuity, the other is an annuity due. Which of the following statements is most correct?
- a. The present value of the ordinary annuity must exceed the present value of the annuity due, but the future value of an ordinary annuity may be less than the future value of the annuity due.
 - b. The present value of the annuity due exceeds the present value of the ordinary annuity, while the future value of the annuity due is less than the future value of the ordinary annuity.
 - c. The present value of the annuity due exceeds the present value of the ordinary annuity, and the future value of the annuity due also exceeds the future value of the ordinary annuity.
 - d. If interest rates increase, the difference between the present value of the ordinary annuity and the present value of the annuity due remains the same.
 - e. Statements a and d are correct.

Time value concepts

Answer: e Diff: M

12. A \$10,000 loan is to be amortized over 5 years, with annual end-of-year payments. Given the following facts, which of these statements is most correct?
- a. The annual payments would be larger if the interest rate were lower.
 - b. If the loan were amortized over 10 years rather than 5 years, and if the interest rate were the same in either case, the first payment would include more dollars of interest under the 5-year amortization plan.
 - c. The last payment would have a higher proportion of interest than the first payment.
 - d. The proportion of interest versus principal repayment would be the same for each of the 5 payments.
 - e. The proportion of each payment that represents interest as opposed to repayment of principal would be higher if the interest rate were higher.

Time value concepts

Answer: e Diff: M

13. Which of the following is most correct?

- a. The present value of a 5-year annuity due will exceed the present value of a 5-year ordinary annuity. (Assume that both annuities pay \$100 per period and there is no chance of default.)
- b. If a loan has a nominal rate of 10 percent, then the effective rate can never be less than 10 percent.
- c. If there is annual compounding, then the effective, periodic, and nominal rates of interest are all the same.
- d. Statements a and c are correct.
- e. All of the statements above are correct.

Time value concepts

Answer: c Diff: M

14. Which of the following statements is most correct?

- a. An investment that compounds interest semiannually, and has a nominal rate of 10 percent, will have an effective rate less than 10 percent.
- b. The present value of a 3-year \$100 annuity due is less than the present value of a 3-year \$100 ordinary annuity.
- c. The proportion of the payment of a fully amortized loan that goes toward interest declines over time.
- d. Statements a and c are correct.
- e. None of the statements above is correct.

Tough:

Time value concepts

Answer: e Diff: T

15. Which of the following statements is most correct?

- a. The first payment under a 3-year, annual payment, amortized loan for \$1,000 will include a smaller percentage (or fraction) of interest if the interest rate is 5 percent than if it is 10 percent.
- b. If you are lending money, then, based on effective interest rates, you should prefer to lend at a 10 percent nominal, or quoted, rate but with semiannual payments, rather than at a 10.1 percent nominal rate with annual payments. However, as a borrower you should prefer the annual payment loan.
- c. The value of a perpetuity (say for \$100 per year) will approach infinity as the interest rate used to evaluate the perpetuity approaches zero.
- d. Statements b and c are correct.
- e. All of the statements above are correct.

Multiple Choice: Problems

Easy:

FV of a sum

Answer: b Diff: E

16. You deposited \$1,000 in a savings account that pays 8 percent interest, compounded quarterly, planning to use it to finish your last year in college. Eighteen months later, you decide to go to the Rocky Mountains to become a ski instructor rather than continue in school, so you close out your account. How much money will you receive?
- a. \$1,171
 - b. \$1,126
 - c. \$1,082
 - d. \$1,163
 - e. \$1,008

FV of an annuity

Answer: e Diff: E

17. What is the future value of a 5-year ordinary annuity with annual payments of \$200, evaluated at a 15 percent interest rate?
- a. \$ 670.44
 - b. \$ 842.91
 - c. \$1,169.56
 - d. \$1,522.64
 - e. \$1,348.48

FV of an annuity

Answer: a Diff: E N

18. Today is your 23rd birthday. Your aunt just gave you \$1,000. You have used the money to open up a brokerage account. Your plan is to contribute an additional \$2,000 to the account each year on your birthday, up through and including your 65th birthday, starting next year. The account has an annual expected return of 12 percent. How much do you expect to have in the account right after you make the final \$2,000 contribution on your 65th birthday?
- a. \$2,045,442
 - b. \$1,811,996
 - c. \$2,292,895
 - d. \$1,824,502
 - e. \$2,031,435

FV of annuity due**Answer: d Diff: E N**

19. Today is Janet's 23rd birthday. Starting today, Janet plans to begin saving for her retirement. Her plan is to contribute \$1,000 to a brokerage account each year on her birthday. Her first contribution will take place today. Her 42nd and final contribution will take place on her 64th birthday. Her aunt has decided to help Janet with her savings, which is why she gave Janet \$10,000 today as a birthday present to help get her account started. Assume that the account has an expected annual return of 10 percent. How much will Janet expect to have in her account on her 65th birthday?

- a. \$ 985,703.62
- b. \$1,034,488.80
- c. \$1,085,273.98
- d. \$1,139,037.68
- e. \$1,254,041.45

PV of an annuity**Answer: a Diff: E**

20. What is the present value of a 5-year ordinary annuity with annual payments of \$200, evaluated at a 15 percent interest rate?

- a. \$ 670.43
- b. \$ 842.91
- c. \$1,169.56
- d. \$1,348.48
- e. \$1,522.64

PV of a perpetuity**Answer: c Diff: E**

21. You have the opportunity to buy a perpetuity that pays \$1,000 annually. Your required rate of return on this investment is 15 percent. You should be essentially indifferent to buying or not buying the investment if it were offered at a price of

- a. \$5,000.00
- b. \$6,000.00
- c. \$6,666.67
- d. \$7,500.00
- e. \$8,728.50

PV of an uneven CF stream**Answer: b Diff: E**

22. A real estate investment has the following expected cash flows:

<u>Year</u>	<u>Cash Flows</u>
1	\$10,000
2	25,000
3	50,000
4	35,000

The discount rate is 8 percent. What is the investment's present value?

- a. \$103,799
- b. \$ 96,110
- c. \$ 95,353
- d. \$120,000
- e. \$ 77,592

PV of an uneven CF stream**Answer: c Diff: E**

23. Assume that you will receive \$2,000 a year in Years 1 through 5, \$3,000 a year in Years 6 through 8, and \$4,000 in Year 9, with all cash flows to be received at the end of the year. If you require a 14 percent rate of return, what is the present value of these cash flows?

- a. \$ 9,851
- b. \$13,250
- c. \$11,714
- d. \$15,129
- e. \$17,353

Required annuity payments**Answer: b Diff: E**

24. If a 5-year ordinary annuity has a present value of \$1,000, and if the interest rate is 10 percent, what is the amount of each annuity payment?

- a. \$240.42
- b. \$263.80
- c. \$300.20
- d. \$315.38
- e. \$346.87

Quarterly compounding**Answer: a Diff: E**

25. If \$100 is placed in an account that earns a nominal 4 percent, compounded quarterly, what will it be worth in 5 years?

- a. \$122.02
- b. \$105.10
- c. \$135.41
- d. \$120.90
- e. \$117.48

Growth rate**Answer: d Diff: E**

26. In 1958 the average tuition for one year at an Ivy League school was \$1,800. Thirty years later, in 1988, the average cost was \$13,700. What was the growth rate in tuition over the 30-year period?
- a. 12%
 - b. 9%
 - c. 6%
 - d. 7%
 - e. 8%

Effect of inflation**Answer: c Diff: E**

27. At an inflation rate of 9 percent, the purchasing power of \$1 would be cut in half in 8.04 years. How long to the nearest year would it take the purchasing power of \$1 to be cut in half if the inflation rate were only 4 percent?
- a. 12 years
 - b. 15 years
 - c. 18 years
 - d. 20 years
 - e. 23 years

Interest rate**Answer: b Diff: E**

28. South Penn Trucking is financing a new truck with a loan of \$10,000 to be repaid in 5 annual end-of-year installments of \$2,504.56. What annual interest rate is the company paying?
- a. 7%
 - b. 8%
 - c. 9%
 - d. 10%
 - e. 11%

Effective annual rate**Answer: c Diff: E**

29. Gomez Electronics needs to arrange financing for its expansion program. Bank A offers to lend Gomez the required funds on a loan in which interest must be paid monthly, and the quoted rate is 8 percent. Bank B will charge 9 percent, with interest due at the end of the year. What is the difference in the effective annual rates charged by the two banks?
- a. 0.25%
 - b. 0.50%
 - c. 0.70%
 - d. 1.00%
 - e. 1.25%

Effective annual rate**Answer: b Diff: E**

30. You recently received a letter from Cut-to-the-Chase National Bank that offers you a new credit card that has no annual fee. It states that the annual percentage rate (APR) is 18 percent on outstanding balances. What is the effective annual interest rate? (Hint: Remember these companies bill you monthly.)
- a. 18.81%
 - b. 19.56%
 - c. 19.25%
 - d. 20.00%
 - e. 18.00%

Effective annual rate**Answer: b Diff: E**

31. Which of the following investments has the highest effective annual rate (EAR)? (Assume that all CDs are of equal risk.)
- a. A bank CD that pays 10 percent interest quarterly.
 - b. A bank CD that pays 10 percent monthly.
 - c. A bank CD that pays 10.2 percent annually.
 - d. A bank CD that pays 10 percent semiannually.
 - e. A bank CD that pays 9.6 percent daily (on a 365-day basis).

Effective annual rate**Answer: c Diff: E**

32. You want to borrow \$1,000 from a friend for one year, and you propose to pay her \$1,120 at the end of the year. She agrees to lend you the \$1,000, but she wants you to pay her \$10 of interest at the end of each of the first 11 months plus \$1,010 at the end of the 12th month. How much higher is the effective annual rate under your friend's proposal than under your proposal?
- a. 0.00%
 - b. 0.45%
 - c. 0.68%
 - d. 0.89%
 - e. 1.00%

Effective annual rate**Answer: b Diff: E**

33. Elizabeth has \$35,000 in an investment account. Her goal is to have the account grow to \$100,000 in 10 years without having to make any additional contributions to the account. What effective annual rate of interest would she need to earn on the account in order to meet her goal?
- a. 9.03%
 - b. 11.07%
 - c. 10.23%
 - d. 8.65%
 - e. 12.32%

Effective annual rate**Answer: a Diff: E**

34. Which one of the following investments provides the highest effective rate of return?
- a. An investment that has a 9.9 percent nominal rate and quarterly annual compounding.
 - b. An investment that has a 9.7 percent nominal rate and daily (365) compounding.
 - c. An investment that has a 10.2 percent nominal rate and annual compounding.
 - d. An investment that has a 10 percent nominal rate and semiannual compounding.
 - e. An investment that has a 9.6 percent nominal rate and monthly compounding.

Effective annual rate**Answer: b Diff: E**

35. Which of the following investments would provide an investor the highest effective annual rate of return?
- a. An investment that has a 9 percent nominal rate with semiannual compounding.
 - b. An investment that has a 9 percent nominal rate with quarterly compounding.
 - c. An investment that has a 9.2 percent nominal rate with annual compounding.
 - d. An investment that has an 8.9 percent nominal rate with monthly compounding.
 - e. An investment that has an 8.9 percent nominal rate with quarterly compounding.

Nominal and effective rates**Answer: b Diff: E**

36. An investment pays you 9 percent interest compounded semiannually. A second investment of equal risk, pays interest compounded quarterly. What nominal rate of interest would you have to receive on the second investment in order to make you indifferent between the two investments?
- a. 8.71%
 - b. 8.90%
 - c. 9.00%
 - d. 9.20%
 - e. 9.31%

Time for a sum to double**Answer: d Diff: E**

37. You are currently investing your money in a bank account that has a nominal annual rate of 7 percent, compounded monthly. How many years will it take for you to double your money?
- a. 8.67
 - b. 9.15
 - c. 9.50
 - d. 9.93
 - e. 10.25

Time for lump sum to grow**Answer: e Diff: E N**

38. Jill currently has \$300,000 in a brokerage account. The account pays a 10 percent annual interest rate. Assuming that Jill makes no additional contributions to the account, how many years will it take for her to have \$1,000,000 in the account?
- a. 23.33 years
 - b. 3.03 years
 - c. 16.66 years
 - d. 33.33 years
 - e. 12.63 years

Time value of money and retirement**Answer: b Diff: E**

39. Today, Bruce and Brenda each have \$150,000 in an investment account. No other contributions will be made to their investment accounts. Both have the same goal: They each want their account to reach \$1 million, at which time each will retire. Bruce has his money invested in risk-free securities with an expected annual return of 5 percent. Brenda has her money invested in a stock fund with an expected annual return of 10 percent. How many years after Brenda retires will Bruce retire?
- a. 12.6
 - b. 19.0
 - c. 19.9
 - d. 29.4
 - e. 38.9

Monthly loan payments**Answer: c Diff: E**

40. You are considering buying a new car. The sticker price is \$15,000 and you have \$2,000 to put toward a down payment. If you can negotiate a nominal annual interest rate of 10 percent and you wish to pay for the car over a 5-year period, what are your monthly car payments?
- a. \$216.67
 - b. \$252.34
 - c. \$276.21
 - d. \$285.78
 - e. \$318.71

Remaining loan balance**Answer: a Diff: E**

41. A bank recently loaned you \$15,000 to buy a car. The loan is for five years (60 months) and is fully amortized. The nominal rate on the loan is 12 percent, and payments are made at the end of each month. What will be the remaining balance on the loan after you make the 30th payment?
- a. \$ 8,611.17
 - b. \$ 8,363.62
 - c. \$14,515.50
 - d. \$ 8,637.38
 - e. \$ 7,599.03

Remaining loan balance**Answer: b Diff: E**

42. Robert recently borrowed \$20,000 to purchase a new car. The car loan is fully amortized over 4 years. In other words, the loan has a fixed monthly payment, and the loan balance will be zero after the final monthly payment is made. The loan has a nominal interest rate of 12 percent with monthly compounding. Looking ahead, Robert thinks there is a chance that he will want to pay off the loan early, after 3 years (36 months). What will be the remaining balance on the loan after he makes the 36th payment?
- a. \$7,915.56
 - b. \$5,927.59
 - c. \$4,746.44
 - d. \$4,003.85
 - e. \$5,541.01

Remaining mortgage balance**Answer: c Diff: E**

43. Jerry and Faith Hudson recently obtained a 30-year (360-month), \$250,000 mortgage with a 9 percent nominal interest rate. What will be the remaining balance on the mortgage after five years (60 months)?
- a. \$239,024
 - b. \$249,307
 - c. \$239,700
 - d. \$237,056
 - e. \$212,386

Remaining mortgage balance**Answer: d Diff: E**

44. You just bought a house and have a \$150,000 mortgage. The mortgage is for 30 years and has a nominal rate of 8 percent (compounded monthly). After 36 payments (3 years) what will be the remaining balance on your mortgage?
- a. \$110,376.71
 - b. \$124,565.82
 - c. \$144,953.86
 - d. \$145,920.12
 - e. \$148,746.95

Remaining mortgage balance**Answer: d Diff: E**

45. Your family purchased a house three years ago. When you bought the house you financed it with a \$160,000 mortgage with an 8.5 percent nominal interest rate (compounded monthly). The mortgage was for 15 years (180 months). What is the remaining balance on your mortgage today?
- a. \$ 95,649
 - b. \$103,300
 - c. \$125,745
 - d. \$141,937
 - e. \$159,998

Remaining mortgage balance**Answer: c Diff: E**

46. You recently took out a 30-year (360 months), \$145,000 mortgage. The mortgage payments are made at the end of each month and the nominal interest rate on the mortgage is 7 percent. After five years (60 payments), what will be the remaining balance on the mortgage?
- a. \$ 87,119
 - b. \$136,172
 - c. \$136,491
 - d. \$136,820
 - e. \$143,527

Remaining mortgage balance**Answer: b Diff: E**

47. A 30-year, \$175,000 mortgage has a nominal interest rate of 7.45 percent. Assume that all payments are made at the end of each month. What will be the remaining balance on the mortgage after 5 years (60 monthly payments)?
- a. \$ 63,557
 - b. \$165,498
 - c. \$210,705
 - d. \$106,331
 - e. \$101,942

Amortization**Answer: c Diff: E**

48. The Howe family recently bought a house. The house has a 30-year, \$165,000 mortgage with monthly payments and a nominal interest rate of 8 percent. What is the total dollar amount of interest the family will pay during the first three years of their mortgage? (Assume that all payments are made at the end of the month.)
- a. \$ 3,297.78
 - b. \$38,589.11
 - c. \$39,097.86
 - d. \$43,758.03
 - e. \$44,589.11

FV under monthly compounding**Answer: a Diff: E N**

49. Bill plans to deposit \$200 into a bank account at the end of every month. The bank account has a nominal interest rate of 8 percent and interest is compounded monthly. How much will Bill have in the account at the end of 2½ years (30 months)?
- a. \$ 6,617.77
 - b. \$ 502.50
 - c. \$ 6,594.88
 - d. \$22,656.74
 - e. \$ 5,232.43

Medium:

Monthly vs. quarterly compounding

Answer: c Diff: M

50. On its savings accounts, the First National Bank offers a 5 percent nominal interest rate that is compounded monthly. Savings accounts at the Second National Bank have the same effective annual return, but interest is compounded quarterly. What nominal rate does the Second National Bank offer on its savings accounts?
- a. 5.12%
 - b. 5.00%
 - c. 5.02%
 - d. 1.28%
 - e. 5.22%

Present value

Answer: c Diff: M N

51. Which of the following securities has the largest present value? Assume in all cases that the annual interest rate is 8 percent and that there are no taxes.
- a. A five-year ordinary annuity that pays you \$1,000 each year.
 - b. A five-year zero coupon bond that has a face value of \$7,000.
 - c. A preferred stock issue that pays an \$800 annual dividend in perpetuity. (Assume that the first dividend is received one year from today.)
 - d. A seven-year zero coupon bond that has a face value of \$8,500.
 - e. A security that pays you \$1,000 at the end of 1 year, \$2,000 at the end of 2 years, and \$3,000 at the end of 3 years.

PV under monthly compounding

Answer: b Diff: M

52. You have just bought a security that pays \$500 every six months. The security lasts for 10 years. Another security of equal risk also has a maturity of 10 years, and pays 10 percent compounded monthly (that is, the nominal rate is 10 percent). What should be the price of the security that you just purchased?
- a. \$6,108.46
 - b. \$6,175.82
 - c. \$6,231.11
 - d. \$6,566.21
 - e. \$7,314.86

PV under non-annual compounding

Answer: c Diff: M

53. You have been offered an investment that pays \$500 at the end of every 6 months for the next 3 years. The nominal interest rate is 12 percent; however, interest is compounded quarterly. What is the present value of the investment?
- a. \$2,458.66
 - b. \$2,444.67
 - c. \$2,451.73
 - d. \$2,463.33
 - e. \$2,437.56

PV of an annuity**Answer: a Diff: M**

54. Your subscription to Jogger's World Monthly is about to run out and you have the choice of renewing it by sending in the \$10 a year regular rate or of getting a lifetime subscription to the magazine by paying \$100. Your cost of capital is 7 percent. How many years would you have to live to make the lifetime subscription the better buy? Payments for the regular subscription are made at the beginning of each year. (Round up if necessary to obtain a whole number of years.)
- a. 15 years
 - b. 10 years
 - c. 18 years
 - d. 7 years
 - e. 8 years

FV of an annuity**Answer: e Diff: M**

55. Your bank account pays a nominal interest rate of 6 percent, but interest is compounded daily (on a 365-day basis). Your plan is to deposit \$500 in the account today. You also plan to deposit \$1,000 in the account at the end of each of the next three years. How much will you have in the account at the end of three years, after making your final deposit?
- a. \$2,591
 - b. \$3,164
 - c. \$3,500
 - d. \$3,779
 - e. \$3,788

FV of an annuity**Answer: c Diff: M**

56. Terry Austin is 30 years old and is saving for her retirement. She is planning on making 36 contributions to her retirement account at the beginning of each of the next 36 years. The first contribution will be made today ($t = 0$) and the final contribution will be made 35 years from today ($t = 35$). The retirement account will earn a return of 10 percent a year. If each contribution she makes is \$3,000, how much will be in the retirement account 35 years from now ($t = 35$)?
- a. \$894,380
 - b. \$813,073
 - c. \$897,380
 - d. \$987,118
 - e. \$978,688

FV of an annuity**Answer: d Diff: M N**

57. Today is your 20th birthday. Your parents just gave you \$5,000 that you plan to use to open a stock brokerage account. Your plan is to add \$500 to the account each year on your birthday. Your first \$500 contribution will come one year from now on your 21st birthday. Your 45th and final \$500 contribution will occur on your 65th birthday. You plan to withdraw \$5,000 from the account five years from now on your 25th birthday to take a trip to Europe. You also anticipate that you will need to withdraw \$10,000 from the account 10 years from now on your 30th birthday to take a trip to Asia. You expect that the account will have an average annual return of 12 percent. How much money do you anticipate that you will have in the account on your 65th birthday, following your final contribution?
- a. \$385,863
 - b. \$413,028
 - c. \$457,911
 - d. \$505,803
 - e. \$566,498

FV of annuity due**Answer: d Diff: M**

58. You are contributing money to an investment account so that you can purchase a house in five years. You plan to contribute six payments of \$3,000 a year. The first payment will be made today ($t = 0$) and the final payment will be made five years from now ($t = 5$). If you earn 11 percent in your investment account, how much money will you have in the account five years from now (at $t = 5$)?
- a. \$19,412
 - b. \$20,856
 - c. \$21,683
 - d. \$23,739
 - e. \$26,350

FV of annuity due**Answer: e Diff: M**

59. Today is your 21st birthday, and you are opening up an investment account. Your plan is to contribute \$2,000 per year on your birthday and the first contribution will be made today. Your 45th, and final, contribution will be made on your 65th birthday. If you earn 10 percent a year on your investments, how much money will you have in the account on your 65th birthday, immediately after making your final contribution?
- a. \$1,581,590.64
 - b. \$1,739,749.71
 - c. \$1,579,590.64
 - d. \$1,387,809.67
 - e. \$1,437,809.67

FV of a sum**Answer: d Diff: M**

60. Suppose you put \$100 into a savings account today, the account pays a nominal annual interest rate of 6 percent, but compounded semiannually, and you withdraw \$100 after 6 months. What would your ending balance be 20 years after the initial \$100 deposit was made?
- a. \$226.20
 - b. \$115.35
 - c. \$ 62.91
 - d. \$ 9.50
 - e. \$ 3.00

FV under monthly compounding**Answer: e Diff: M**

61. You just put \$1,000 in a bank account that pays 6 percent nominal annual interest, compounded monthly. How much will you have in your account after 3 years?
- a. \$1,006.00
 - b. \$1,056.45
 - c. \$1,180.32
 - d. \$1,191.00
 - e. \$1,196.68

FV under monthly compounding**Answer: d Diff: M**

62. Steven just deposited \$10,000 in a bank account that has a 12 percent nominal interest rate, and the interest is compounded monthly. Steven also plans to contribute another \$10,000 to the account one year (12 months) from now and another \$20,000 to the account two years from now. How much will be in the account three years (36 months) from now?
- a. \$57,231
 - b. \$48,993
 - c. \$50,971
 - d. \$49,542
 - e. \$49,130

FV under daily compounding**Answer: a Diff: M**

63. You have \$2,000 invested in a bank account that pays a 4 percent nominal annual interest with daily compounding. How much money will you have in the account at the end of July (in 132 days)? (Assume there are 365 days in each year.)
- a. \$2,029.14
 - b. \$2,028.93
 - c. \$2,040.00
 - d. \$2,023.44
 - e. \$2,023.99

FV under daily compounding**Answer: d Diff: M N**

64. The Martin family recently deposited \$1,000 in a bank account that pays a 6 percent nominal interest rate. Interest in the account will be compounded daily (365 days = 1 year). How much will they have in the account after 5 years?
- a. \$1,000.82
 - b. \$1,433.29
 - c. \$1,338.23
 - d. \$1,349.82
 - e. \$1,524.77

FV under non-annual compounding**Answer: d Diff: M**

65. Josh and John (2 brothers) are each trying to save enough money to buy their own cars. Josh is planning to save \$100 from every paycheck. (He is paid every 2 weeks.) John plans to put aside \$150 each month but has already saved \$1,500. Interest rates are currently quoted at 10 percent. Josh's bank compounds interest every two weeks while John's bank compounds interest monthly. At the end of 2 years they will each spend all their savings on a car. (Each brother will buy a car.) What is the price of the most expensive car purchased?
- a. \$5,744.29
 - b. \$5,807.48
 - c. \$5,703.02
 - d. \$5,797.63
 - e. \$5,898.50

FV under quarterly compounding**Answer: c Diff: M**

66. An investment pays \$100 every six months (semiannually) over the next 2.5 years. Interest, however, is compounded quarterly, at a nominal rate of 8 percent. What is the future value of the investment after 2.5 years?
- a. \$520.61
 - b. \$541.63
 - c. \$542.07
 - d. \$543.98
 - e. \$547.49

FV under quarterly compounding**Answer: d Diff: M**

67. Rachel wants to take a trip to England in 3 years, and she has started a savings account today to pay for the trip. Today (8/1/02) she made an initial deposit of \$1,000. Her plan is to add \$2,000 to the account one year from now (8/1/03) and another \$3,000 to the account two years from now (8/1/04). The account has a nominal interest rate of 7 percent, but the interest is compounded quarterly. How much will Rachel have in the account three years from today (8/1/05)?
- a. \$6,724.84
 - b. \$6,701.54
 - c. \$6,895.32
 - d. \$6,744.78
 - e. \$6,791.02

Non-annual compounding**Answer: c Diff: M N**

68. Katherine wants to open a savings account, and she has obtained account information from two banks. Bank A has a nominal annual rate of 9 percent, with interest compounded quarterly. Bank B offers the same effective annual rate, but it compounds interest monthly. What is the nominal annual rate of return for a savings account from Bank B?
- a. 8.906%
 - b. 8.920%
 - c. 8.933%
 - d. 8.951%
 - e. 9.068%

FV of an uneven CF stream**Answer: e Diff: M**

69. You are interested in saving money for your first house. Your plan is to make regular deposits into a brokerage account that will earn 14 percent. Your first deposit of \$5,000 will be made today. You also plan to make four additional deposits at the beginning of each of the next four years. Your plan is to increase your deposits by 10 percent a year. (That is, you plan to deposit \$5,500 at $t = 1$, and \$6,050 at $t = 2$, etc.) How much money will be in your account after five years?
- a. \$24,697.40
 - b. \$30,525.00
 - c. \$32,485.98
 - d. \$39,362.57
 - e. \$44,873.90

FV of an uneven CF stream**Answer: d Diff: M**

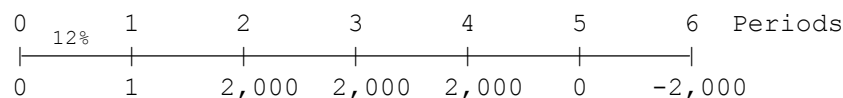
70. You just graduated, and you plan to work for 10 years and then to leave for the Australian "Outback" bush country. You figure you can save \$1,000 a year for the first 5 years and \$2,000 a year for the next 5 years. These savings cash flows will start one year from now. In addition, your family has just given you a \$5,000 graduation gift. If you put the gift now, and your future savings when they start, into an account that pays 8 percent compounded annually, what will your financial "stake" be when you leave for Australia 10 years from now?
- a. \$21,432
 - b. \$28,393
 - c. \$16,651
 - d. \$31,148
 - e. \$20,000

FV of an uneven CF stream**Answer: c Diff: M N**

71. Erika opened a savings account today and she immediately put \$10,000 into it. She plans to contribute another \$20,000 one year from now, and \$50,000 two years from now. The savings account pays a 6 percent annual interest rate. If she makes no other deposits or withdrawals, how much will she have in the account 10 years from today?
- a. \$ 8,246.00
 - b. \$116,937.04
 - c. \$131,390.46
 - d. \$164,592.62
 - e. \$190,297.04

PV of an uneven CF stream**Answer: a Diff: M**

72. You are given the following cash flows. What is the present value ($t = 0$) if the discount rate is 12 percent?



- a. \$3,277
- b. \$4,804
- c. \$5,302
- d. \$4,289
- e. \$2,804

PV of uncertain cash flows**Answer: e Diff: M**

73. A project with a 3-year life has the following probability distributions for possible end-of-year cash flows in each of the next three years:

Year 1		Year 2		Year 3	
Prob	Cash Flow	Prob	Cash Flow	Prob	Cash Flow
0.30	\$300	0.15	\$100	0.25	\$200
0.40	500	0.35	200	0.75	800
0.30	700	0.35	600		
		0.15	900		

Using an interest rate of 8 percent, find the expected present value of these uncertain cash flows. (Hint: Find the expected cash flow in each year, then evaluate those cash flows.)

- a. \$1,204.95
- b. \$ 835.42
- c. \$1,519.21
- d. \$1,580.00
- e. \$1,347.61

Value of missing cash flow**Answer: d Diff: M**

74. Foster Industries has a project that has the following cash flows:

Year	Cash Flow
0	-\$300.00
1	100.00
2	125.43
3	90.12
4	?

What cash flow will the project have to generate in the fourth year in order for the project to have a 15 percent rate of return?

- a. \$ 15.55
- b. \$ 58.95
- c. \$100.25
- d. \$103.10
- e. \$150.75

Value of missing cash flow**Answer: c Diff: M**

75. John Keene recently invested \$2,566.70 in a project that is promising to return 12 percent per year. The cash flows are expected to be as follows:

<u>End of Year</u>	<u>Cash Flow</u>
1	\$325
2	400
3	550
4	?
5	750
6	800

What is the cash flow at the end of the 4th year?

- a. \$1,187
- b. \$ 600
- c. \$1,157
- d. \$ 655
- e. \$1,267

Value of missing payments**Answer: d Diff: M**

76. You recently purchased a 20-year investment that pays you \$100 at $t = 1$, \$500 at $t = 2$, \$750 at $t = 3$, and some fixed cash flow, X , at the end of each of the remaining 17 years. You purchased the investment for \$5,544.87. Alternative investments of equal risk have a required return of 9 percent. What is the annual cash flow received at the end of each of the final 17 years, that is, what is X ?

- a. \$600
- b. \$625
- c. \$650
- d. \$675
- e. \$700

Value of missing payments**Answer: c Diff: M**

77. A 10-year security generates cash flows of \$2,000 a year at the end of each of the next three years ($t = 1, 2$, and 3). After three years, the security pays some constant cash flow at the end of each of the next six years ($t = 4, 5, 6, 7, 8$, and 9). Ten years from now ($t = 10$) the security will mature and pay \$10,000. The security sells for \$24,307.85 and has a yield to maturity of 7.3 percent. What annual cash flow does the security pay for years 4 through 9?

- a. \$2,995
- b. \$3,568
- c. \$3,700
- d. \$3,970
- e. \$4,296

Value of missing payments**Answer: d Diff: M**

78. An investment costs \$3,000 today and provides cash flows at the end of each year for 20 years. The investment's expected return is 10 percent. The projected cash flows for Years 1, 2, and 3 are \$100, \$200, and \$300, respectively. What is the annual cash flow received for each of Years 4 through 20 (17 years)? (Assume the same payment for each of these years.)
- a. \$285.41
 - b. \$313.96
 - c. \$379.89
 - d. \$417.87
 - e. \$459.66

Amortization**Answer: c Diff: M**

79. If you buy a factory for \$250,000 and the terms are 20 percent down, the balance to be paid off over 30 years at a 12 percent rate of interest on the unpaid balance, what are the 30 equal annual payments?
- a. \$20,593
 - b. \$31,036
 - c. \$24,829
 - d. \$50,212
 - e. \$ 6,667

Amortization**Answer: a Diff: M**

80. You have just taken out an installment loan for \$100,000. Assume that the loan will be repaid in 12 equal monthly installments of \$9,456 and that the first payment will be due one month from today. How much of your third monthly payment will go toward the repayment of principal?
- a. \$7,757.16
 - b. \$6,359.12
 - c. \$7,212.50
 - d. \$7,925.88
 - e. \$8,333.33

Amortization**Answer: c Diff: M**

81. A homeowner just obtained a \$90,000 mortgage. The mortgage is for 30 years (360 months) and has a fixed nominal annual rate of 9 percent, with monthly payments. What percentage of the total payments made the first two years will go toward payment of interest?
- a. 89.30%
 - b. 91.70%
 - c. 92.59%
 - d. 93.65%
 - e. 94.76%

Amortization**Answer: e Diff: M**

82. You recently obtained a \$135,000, 30-year mortgage with a nominal interest rate of 7.25 percent. Assume that payments are made at the end of each month. What portion of the total payments made during the fourth year will go towards the repayment of principal?
- a. 9.70%
 - b. 15.86%
 - c. 13.75%
 - d. 12.85%
 - e. 14.69%

Amortization**Answer: b Diff: M**

83. John and Peggy recently bought a house, and they financed it with a \$125,000, 30-year mortgage with a nominal interest rate of 7 percent. Mortgage payments are made at the end of each month. What portion of their mortgage payments during the first three years will go towards repayment of principal?
- a. 12.81%
 - b. 13.67%
 - c. 14.63%
 - d. 15.83%
 - e. 17.14%

Amortization**Answer: b Diff: M N**

84. The Taylor family has a \$250,000 mortgage. The mortgage is for 15 years, and has a nominal rate of 8 percent. Mortgage payments are due at the end of each month. What percentage of the monthly payments during the fifth year goes towards repayment of principal?
- a. 46.60%
 - b. 43.16%
 - c. 57.11%
 - d. 19.32%
 - e. 56.84%

Remaining mortgage balance**Answer: b Diff: M N**

85. The Bunker Family recently entered into a 30-year mortgage for \$300,000. The mortgage has an 8 percent nominal interest rate. Interest is compounded monthly, and all payments are due at the end of the month. What will be the remaining balance on the mortgage after five years?
- a. \$ 14,790.43
 - b. \$285,209.57
 - c. \$300,000.00
 - d. \$366,177.71
 - e. \$298,980.02

Remaining loan balance**Answer: d Diff: M**

86. Jamie and Jake each recently bought a different new car. Both received a loan from a local bank. Both loans have a nominal interest rate of 12 percent with payments made at the end of each month, are fully amortizing, and have the same monthly payment. Jamie's loan is for \$15,000; however, his loan matures at the end of 4 years (48 months), while Jake's loan matures in 5 years (60 months). After 48 months Jamie's loan will be paid off. At the end of 48 months what will be the remaining balance on Jake's loan?

- a. \$ 1,998.63
- b. \$ 2,757.58
- c. \$ 3,138.52
- d. \$ 4,445.84
- e. \$11,198.55

Effective annual rate**Answer: b Diff: M**

87. If it were evaluated with an interest rate of 0 percent, a 10-year regular annuity would have a present value of \$3,755.50. If the future (compounded) value of this annuity, evaluated at Year 10, is \$5,440.22, what effective annual interest rate must the analyst be using to find the future value?

- a. 7%
- b. 8%
- c. 9%
- d. 10%
- e. 11%

Effective annual rate**Answer: d Diff: M**

88. Steaks Galore needs to arrange financing for its expansion program. One bank offers to lend the required \$1,000,000 on a loan that requires interest to be paid at the end of each quarter. The quoted rate is 10 percent, and the principal must be repaid at the end of the year. A second lender offers 9 percent, daily compounding (365-day year), with interest and principal due at the end of the year. What is the difference in the effective annual rates (EFF%) charged by the two banks?

- a. 0.31%
- b. 0.53%
- c. 0.75%
- d. 0.96%
- e. 1.25%

Effective annual rate**Answer: e Diff: M**

89. You have just taken out a 10-year, \$12,000 loan to purchase a new car. This loan is to be repaid in 120 equal end-of-month installments. If each of the monthly installments is \$150, what is the effective annual interest rate on this car loan?
- a. 6.5431%
 - b. 7.8942%
 - c. 8.6892%
 - d. 8.8869%
 - e. 9.0438%

Nominal vs. effective annual rate**Answer: b Diff: M N**

90. Gilhart First National Bank offers an investment security with a 7.5 percent nominal annual return, compounded quarterly. Gilhart's competitor, Olsen Savings and Loan, is offering a similar security that bears the same risk and same effective rate of return. However, Olsen's security pays interest monthly. What is the nominal annual return of the security offered by Olsen?
- a. 7.39%
 - b. 7.45%
 - c. 7.50%
 - d. 7.54%
 - e. 7.59%

Effective annual rate and annuities**Answer: d Diff: M**

91. You plan to invest \$5,000 at the end of each of the next 10 years in an account that has a 9 percent nominal rate with interest compounded monthly. How much will be in your account at the end of the 10 years?
- a. \$ 75,965
 - b. \$967,571
 - c. \$ 84,616
 - d. \$ 77,359
 - e. \$ 80,631

Value of a perpetuity**Answer: c Diff: M**

92. You are willing to pay \$15,625 to purchase a perpetuity that will pay you and your heirs \$1,250 each year, forever. If your required rate of return does not change, how much would you be willing to pay if this were a 20-year annual payment, ordinary annuity instead of a perpetuity?
- a. \$10,342
 - b. \$11,931
 - c. \$12,273
 - d. \$13,922
 - e. \$17,157

EAR and FV of an annuity**Answer: b Diff: M**

93. An investment pays you \$5,000 at the end of each of the next five years. Your plan is to invest the money in an account that pays 8 percent interest, compounded monthly. How much will you have in the account after receiving the final \$5,000 payment in 5 years (60 months)?
- a. \$ 25,335.56
 - b. \$ 29,508.98
 - c. \$367,384.28
 - d. \$304,969.90
 - e. \$ 25,348.23

Required annuity payments**Answer: c Diff: M**

94. A baseball player is offered a 5-year contract that pays him the following amounts:

Year 1: \$1.2 million
Year 2: 1.6 million
Year 3: 2.0 million
Year 4: 2.4 million
Year 5: 2.8 million

Under the terms of the agreement all payments are made at the end of each year.

Instead of accepting the contract, the baseball player asks his agent to negotiate a contract that has a present value of \$1 million more than that which has been offered. Moreover, the player wants to receive his payments in the form of a 5-year annuity due. All cash flows are discounted at 10 percent. If the team were to agree to the player's terms, what would be the player's annual salary (in millions of dollars)?

- a. \$1.500
- b. \$1.659
- c. \$1.989
- d. \$2.343
- e. \$2.500

Required annuity payments**Answer: b Diff: M**

95. Karen and her twin sister, Kathy, are celebrating their 30th birthday today. Karen has been saving for her retirement ever since their 25th birthday. On their 25th birthday, she made a \$5,000 contribution to her retirement account. Every year thereafter on their birthday, she has added another \$5,000 to the account. Her plan is to continue contributing \$5,000 every year on their birthday. Her 41st, and final, \$5,000 contribution will occur on their 65th birthday.

So far, Kathy has not saved anything for her retirement but she wants to begin today. Kathy's plan is to also contribute a fixed amount every year. Her first contribution will occur today, and her 36th, and final, contribution will occur on their 65th birthday. Assume that both investment accounts earn an annual return of 10 percent. How large does Kathy's annual contribution have to be for her to have the same amount in her account at age 65, as Karen will have in her account at age 65?

- a. \$9,000.00
- b. \$8,154.60
- c. \$7,398.08
- d. \$8,567.20
- e. \$7,933.83

Required annuity payments**Answer: c Diff: M**

96. Jim and Nancy just got married today. They want to start saving so they can buy a house five years from today. The average house in their town today sells for \$120,000. Housing prices are expected to increase 3 percent a year. When they buy their house five years from now, Jim and Nancy expect to get a 30-year (360-month) mortgage with a 7 percent nominal interest rate. They want the monthly payment on their mortgage to be \$500 a month.

Jim and Nancy want to buy an average house in their town. They are starting to save today for a down payment on the house. The down payment plus the mortgage will equal the expected price of the house. Their plan is to deposit \$2,000 in a brokerage account today and then deposit a fixed amount at the end of each of the next five years. Assuming that the brokerage account has an annual return of 10 percent, how much do Jim and Nancy need to deposit at the end of each year in order to accomplish their goal?

- a. \$10,634
- b. \$ 9,044
- c. \$ 9,949
- d. \$ 9,421
- e. \$34,569

Required annuity payments**Answer: a Diff: M N**

97. Today is your 25th birthday. Your goal is to have \$2 million by the time you retire at age 65. So far you have nothing saved, but you plan on making the first contribution to your retirement account today. You plan on making three other contributions to the account, one at age 30, age 35, and age 40. Since you expect that your income will increase rapidly over the next several years, the amount that you contribute at age 30 will be double what you contribute today, the amount at age 35 will be three times what you contribute today, and the amount at age 40 will be four times what you contribute today. Assume that your investments will produce an average annual return of 10 percent. Given your goal and plan, what is the minimum amount you need to contribute to your account today?
- a. \$10,145
 - b. \$10,415
 - c. \$10,700
 - d. \$10,870
 - e. \$11,160

NPV and non-annual discounting**Answer: b Diff: M**

98. Your lease calls for payments of \$500 at the end of each month for the next 12 months. Now your landlord offers you a new 1-year lease that calls for zero rent for 3 months, then rental payments of \$700 at the end of each month for the next 9 months. You keep your money in a bank time deposit that pays a nominal annual rate of 5 percent. By what amount would your net worth change if you accept the new lease? (Hint: Your return per month is $5\%/12 = 0.4166667\%$.)
- a. -\$509.81
 - b. -\$253.62
 - c. +\$125.30
 - d. +\$253.62
 - e. +\$509.81

Tough:**PV of an uneven CF stream****Answer: c Diff: T**

99. Find the present value of an income stream that has a negative flow of \$100 per year for 3 years, a positive flow of \$200 in the 4th year, and a positive flow of \$300 per year in Years 5 through 8. The appropriate discount rate is 4 percent for each of the first 3 years and 5 percent for each of the later years. Thus, a cash flow accruing in Year 8 should be discounted at 5 percent for some years and 4 percent in other years. All payments occur at year-end.
- a. \$ 528.21
 - b. \$1,329.00
 - c. \$ 792.49
 - d. \$1,046.41
 - e. \$ 875.18

PV of an uneven CF stream**Answer: d Diff: T**

100. Hillary is trying to determine the cost of health care to college students and parents' ability to cover those costs. She assumes that the cost of one year of health care for a college student is \$1,000 today, that the average student is 18 when he or she enters college, that inflation in health care cost is rising at the rate of 10 percent per year, and that parents can save \$100 per year to help cover their children's costs. All payments occur at the end of the relevant period, and the \$100/year savings will stop the day the child enters college (hence 18 payments will be made). Savings can be invested at a nominal rate of 6 percent, annual compounding. Hillary wants a health care plan that covers the fully inflated cost of health care for a student for 4 years, during Years 19 through 22 (with payments made at the end of Years 19 through 22). How much would the government have to set aside now (when a child is born), to supplement the average parent's share of a child's college health care cost? The lump sum the government sets aside will also be invested at 6 percent, annual compounding.

- a. \$1,082.76
- b. \$3,997.81
- c. \$5,674.23
- d. \$7,472.08
- e. \$8,554.84

Required annuity payments**Answer: b Diff: T**

101. You are saving for the college education of your two children. One child will enter college in 5 years, while the other child will enter college in 7 years. College costs are currently \$10,000 per year and are expected to grow at a rate of 5 percent per year. All college costs are paid at the beginning of the year. You assume that each child will be in college for four years.

You currently have \$50,000 in your educational fund. Your plan is to contribute a fixed amount to the fund over each of the next 5 years. Your first contribution will come at the end of this year, and your final contribution will come at the date when you make the first tuition payment for your oldest child. You expect to invest your contributions into various investments, which are expected to earn 8 percent per year. How much should you contribute each year in order to meet the expected cost of your children's education?

- a. \$2,894
- b. \$3,712
- c. \$4,125
- d. \$5,343
- e. \$6,750

Required annuity payments**Answer: b Diff: T**

102. A young couple is planning for the education of their two children. They plan to invest the same amount of money at the end of each of the next 16 years. The first contribution will be made at the end of the year and the final contribution will be made at the end of the year the older child enters college.

The money will be invested in securities that are certain to earn a return of 8 percent each year. The older child will begin college in 16 years and the second child will begin college in 18 years. The parents anticipate college costs of \$25,000 a year (per child). These costs must be paid at the end of each year. If each child takes four years to complete their college degrees, then how much money must the couple save each year?

- a. \$ 9,612.10
- b. \$ 5,477.36
- c. \$12,507.29
- d. \$ 5,329.45
- e. \$ 4,944.84

Required annuity payments**Answer: c Diff: T**

103. Your father, who is 60, plans to retire in 2 years, and he expects to live independently for 3 years. He wants a retirement income that has, in the first year, the same purchasing power as \$40,000 has today. However, his retirement income will be a fixed amount, so his real income will decline over time. His retirement income will start the day he retires, 2 years from today, and he will receive a total of 3 retirement payments.

Inflation is expected to be constant at 5 percent. Your father has \$100,000 in savings now, and he can earn 8 percent on savings now and in the future. How much must he save each year, starting today, to meet his retirement goals?

- a. \$1,863
- b. \$2,034
- c. \$2,716
- d. \$5,350
- e. \$6,102

Required annuity payments**Answer: d Diff: T**

104. Your father, who is 60, plans to retire in 2 years, and he expects to live independently for 3 years. Suppose your father wants to have a real income of \$40,000 in today's dollars in each year after he retires. His retirement income will start the day he retires, 2 years from today, and he will receive a total of 3 retirement payments.

Inflation is expected to be constant at 5 percent. Your father has \$100,000 in savings now, and he can earn 8 percent on savings now and in the future. How much must he save each year, starting today, to meet his retirement goals?

- a. \$1,863
- b. \$2,034
- c. \$2,716
- d. \$5,350
- e. \$6,102

Required annuity payments**Answer: c Diff: T**

105. You are considering an investment in a 40-year security. The security will pay \$25 a year at the end of each of the first three years. The security will then pay \$30 a year at the end of each of the next 20 years. The nominal interest rate is assumed to be 8 percent, and the current price (present value) of the security is \$360.39. Given this information, what is the equal annual payment to be received from Year 24 through Year 40 (for 17 years)?

- a. \$35
- b. \$38
- c. \$40
- d. \$45
- e. \$50

Required annuity payments**Answer: a Diff: T**

106. John and Jessica are saving for their child's education. Their daughter is currently eight years old and will be entering college 10 years from now ($t = 10$). College costs are currently \$15,000 a year and are expected to increase at a rate of 5 percent a year. They expect their daughter to graduate in four years, and that all annual payments will be due at the beginning of each year ($t = 10, 11, 12$, and 13).

Right now, John and Jessica have \$5,000 in their college savings account. Starting today, they plan to contribute \$3,000 a year at the beginning of each of the next five years ($t = 0, 1, 2, 3$, and 4). Then their plan is to make six equal annual contributions at the end of each of the following six years ($t = 5, 6, 7, 8, 9$, and 10). Their investment account is expected to have an annual return of 12 percent. How large of an annual payment do they have to make in the subsequent six years ($t = 5, 6, 7, 8, 9$, and 10) in order to meet their child's anticipated college costs?

- a. \$4,411
- b. \$7,643
- c. \$2,925
- d. \$8,015
- e. \$6,798

Required annuity payments**Answer: a Diff: T**

107. Today is Rachel's 30th birthday. Five years ago, Rachel opened a brokerage account when her grandmother gave her \$25,000 for her 25th birthday. Rachel added \$2,000 to this account on her 26th birthday, \$3,000 on her 27th birthday, \$4,000 on her 28th birthday, and \$5,000 on her 29th birthday. Rachel's goal is to have \$400,000 in the account by her 40th birthday.

Starting today, she plans to contribute a fixed amount to the account each year on her birthday. She will make 11 contributions, the first one will occur today, and the final contribution will occur on her 40th birthday. Complicating things somewhat is the fact that Rachel plans to withdraw \$20,000 from the account on her 35th birthday to finance the down payment on a home. How large does each of these 11 contributions have to be for Rachel to reach her goal? Assume that the account has earned (and will continue to earn) an effective return of 12 percent a year.

- a. \$11,743.95
- b. \$10,037.46
- c. \$11,950.22
- d. \$14,783.64
- e. \$ 9,485.67

Required annuity payments**Answer: c Diff: T**

108. John is saving for his retirement. Today is his 40th birthday. John first started saving when he was 25 years old. On his 25th birthday, John made the first contribution to his retirement account; he deposited \$2,000 into an account that paid 9 percent interest, compounded monthly. Each year on his birthday, John contributes another \$2,000 to the account. The 15th (and last) contribution was made last year on his 39th birthday.

John wants to close the account today and move the money to a stock fund that is expected to earn an effective return of 12 percent a year. John's plan is to continue making contributions to this new account each year on his birthday. His next contribution will come today (age 40) and his final planned contribution will be on his 65th birthday. If John wants to accumulate \$3,000,000 in his account by age 65, how much must he contribute each year until age 65 (26 contributions in all) to achieve his goal?

- a. \$11,892
- b. \$13,214
- c. \$12,471
- d. \$10,388
- e. \$15,572

Required annuity payments**Answer: a Diff: T**

109. Joe and Jane are interested in saving money to put their two children, John and Susy through college. John is currently 12 years old and will enter college in six years. Susy is 10 years old and will enter college in 8 years. Both children plan to finish college in four years.

College costs are currently \$15,000 a year (per child), and are expected to increase at 5 percent a year for the foreseeable future. All college costs are paid at the beginning of the school year. Up until now, Joe and Jane have saved nothing but they expect to receive \$25,000 from a favorite uncle in three years.

To provide for the additional funds that are needed, they expect to make 12 equal payments at the beginning of each of the next 12 years--the first payment will be made today and the final payment will be made on Susy's 21st birthday (which is also the day that the last payment must be made to the college). If all funds are invested in a stock fund that is expected to earn 12 percent, how large should each of the annual contributions be?

- a. \$ 7,475.60
- b. \$ 7,798.76
- c. \$ 8,372.67
- d. \$ 9,675.98
- e. \$14,731.90

Required annuity payments**Answer: b Diff: T**

110. John and Barbara Roberts are starting to save for their daughter's college education.

- Assume that today's date is September 1, 2002.
- College costs are currently \$10,000 a year and are expected to increase at a rate equal to 6 percent per year for the foreseeable future. All college payments are due at the beginning of the year. (So for example, college will cost \$10,600 for the year beginning September 1, 2003).
- Their daughter will enter college 15 years from now (September 1, 2017). She will be enrolled for four years. Therefore the Roberts will need to make four tuition payments. The first payment will be made on September 1, 2017, the final payment will be made on September 1, 2020. Notice that because of rising tuition costs, the tuition payments will increase each year.
- The Roberts would also like to give their daughter a lump-sum payment of \$50,000 on September 1, 2021, in order to help with a down payment on a home, or to assist with graduate school tuition.
- The Roberts currently have \$10,000 in their college account. They anticipate making 15 equal contributions to the account at the end of each of the next 15 years. (The first contribution would be made on September 1, 2003, the final contribution will be made on September 1, 2017).
- All current and future investments are assumed to earn an 8 percent return. (Ignore taxes.)

How much should the Roberts contribute each year in order to reach their goal?

- a. \$3,156.69
- b. \$3,618.95
- c. \$4,554.83
- d. \$5,955.54
- e. \$6,279.54

Required annuity payments**Answer: a Diff: T**

111. Joe and June Green are planning for their children's college education. Joe would like his kids to attend his alma mater where tuition is currently \$25,000 per year. Tuition costs are expected to increase by 5 percent each year. Their children, David and Daniel, just turned 2 and 3 years old today, September 1, 2002. They are expected to begin college the year in which they turn 18 years old and each will complete his schooling in four years. College tuition must be paid at the beginning of each school year.

Grandma Green invested \$10,000 in a mutual fund the day each child was born. This was to begin the boys' college fund (a combined fund for both children). The investment has earned and is expected to continue to earn 12 percent per year. Joe and June will now begin adding to this fund every August 31st (beginning with August 31, 2003) to ensure that there is enough money to send the kids to college.

How much money must Joe and June put into the college fund each of the next 15 years if their goal is to have all of the money in the investment account by the time Daniel (the oldest son) begins college?

- a. \$5,928.67
- b. \$7,248.60
- c. \$4,822.66
- d. \$7,114.88
- e. \$5,538.86

Required annuity payments**Answer: a Diff: T**

112. Jerry and Donald are two brothers with the same birthday. Today is Jerry's 30th birthday and Donald's 25th birthday. Donald has been saving for retirement ever since his 20th birthday, when he started his retirement account with a \$10,000 contribution. Every year since, Donald has contributed \$5,000 to the account on his birthday. He plans to make the 40th, and final, \$5,000 contribution on his 60th birthday, after which he plans to retire. In other words, by the time Donald has made all of his contributions he will have made one contribution of \$10,000 followed by 40 annual contributions of \$5,000.

Jerry plans to retire on the same day (which will be his 65th birthday); however, until now, he has saved nothing for retirement. Jerry's plan is to start contributing a fixed amount each year on his birthday; the first contribution will occur today. Jerry's 36th, and final, contribution will occur on his 65th birthday. Jerry's goal is to have the same amount when he retires at age 65 that Donald will have at age 60. Assume that both accounts have an expected annual return of 12 percent. How much does Jerry need to contribute each year in order to meet his goal?

- a. \$ 9,838
- b. \$ 9,858
- c. \$ 9,632
- d. \$10,788
- e. \$11,041

Required annuity payments**Answer: b Diff: T**

113. Bob is 20 years old today and is starting to save money, so that he can get his MBA. He is interested in a 1-year MBA program. Tuition and expenses are currently \$20,000 per year, and they are expected to increase by 5 percent per year. Bob plans to begin his MBA when he is 26 years old, and since all tuition and expenses are due at the beginning of the school year, Bob will make his one single payment six years from today. Right now, Bob has \$25,000 in a brokerage account, and he plans to contribute a fixed amount to the account at the end of each of the next six years ($t = 1, 2, 3, 4, 5,$ and 6). The account is expected to earn an annual return of 10 percent each year. Bob plans to withdraw \$15,000 from the account two years from today ($t = 2$) to purchase a used car, but he plans to make no other withdrawals from the account until he starts the MBA program. How much does Bob need to put in the account at the end of each of the next six years to have enough money to pay for his MBA?

- a. \$1,494
- b. \$ 580
- c. \$4,494
- d. \$2,266
- e. \$3,994

Required annuity payments**Answer: e Diff: T N**

114. Suppose you are deciding whether to buy or lease a car. If you buy the car, it will cost \$17,000 today ($t = 0$). You expect to sell the car four years (48 months) from now for \$6,000 (at $t = 48$). As an alternative to buying the car, you can lease the car for 48 months. All lease payments would be made at the end of the month. The first lease payment would occur next month ($t = 1$) and the final lease payment would occur 48 months from now ($t = 48$). If you buy the car, you would do so with cash, so there is no need to consider financing. If you lease the car, there is no option to buy it at the end of the contract. Assume that there are no taxes, and that the operating costs are the same regardless of whether you buy or lease the car. Assume that all cash flows are discounted at a nominal annual rate of 12 percent, so the monthly periodic rate is 1 percent. What is the breakeven lease payment? (That is, at what monthly payment would you be indifferent between buying and leasing the car?)

- a. \$333.00
- b. \$336.62
- c. \$339.22
- d. \$343.51
- e. \$349.67

Required annuity payments**Answer: c Diff: T N**

115. Today is Craig's 24th birthday, and he wants to begin saving for retirement. To get started, his plan is to open a brokerage account, and to put \$1,000 into the account today. Craig intends to deposit \$X into the account each year on his subsequent birthdays until the age of 64. In other words, Craig plans to make 40 contributions of \$X. The first contribution will be made one year from now on his 25th birthday, and the 40th (and final) contribution will occur on his 64th birthday. Craig plans to retire at age 65 and he expects to live until age 85. Once he retires, Craig estimates that he will need to withdraw \$100,000 from the account each year on his birthday in order to meet his expenses. (That is, Craig plans to make 20 withdrawals of \$100,000 each--the first withdrawal will occur on his 65th birthday and the final one will occur on his 84th birthday.) Craig expects to earn 9 percent a year in his brokerage account. Given his plans, how much does he need to deposit into the account for each of the next 40 years, in order to reach his goal? (That is, what is \$X?)

- a. \$2,379.20
- b. \$2,555.92
- c. \$2,608.73
- d. \$2,657.18
- e. \$2,786.98

Required annuity payments**Answer: a Diff: T N**

116. Your father is 45 years old today. He plans to retire in 20 years. Currently, he has \$50,000 in a brokerage account. He plans to make 20 additional contributions of \$10,000 a year. The first of these contributions will occur one year from today. The 20th and final contribution will occur on his 65th birthday. Once he retires, your father plans to withdraw a fixed dollar amount from the account each year on his birthday. The first withdrawal will occur on his 66th birthday. His 20th and final withdrawal will occur on his 85th birthday. After age 85, your father expects you to take care of him. Your father also plans to leave you with no inheritance. Assume that the brokerage account has an annual expected return of 10 percent. How much will your father be able to withdraw from his account each year after he retires?

- a. \$106,785.48
- b. \$108,683.05
- c. \$111,131.54
- d. \$118,638.62
- e. \$119,022.45

Annuity due vs. ordinary annuity**Answer: e Diff: T**

117. Bill and Bob are both 25 years old today. Each wants to begin saving for his retirement. Both plan on contributing a fixed amount each year into brokerage accounts that have annual returns of 12 percent. Both plan on retiring at age 65, 40 years from today, and both want to have \$3 million saved by age 65. The only difference is that Bill wants to begin saving today, whereas Bob wants to begin saving one year from today. In other words, Bill plans to make 41 total contributions ($t = 0, 1, 2, \dots 40$), while Bob plans to make 40 total contributions ($t = 1, 2, \dots 40$). How much more than Bill will Bob need to save each year in order to accumulate the same amount as Bill does by age 65?

- a. \$796.77
- b. \$892.39
- c. \$473.85
- d. \$414.48
- e. \$423.09

Amortization**Answer: b Diff: T**

118. The Florida Boosters Association has decided to build new bleachers for the football field. Total costs are estimated to be \$1 million, and financing will be through a bond issue of the same amount. The bond will have a maturity of 20 years, a coupon rate of 8 percent, and has annual payments. In addition, the Association must set up a reserve to pay off the loan by making 20 equal annual payments into an account that pays 8 percent, annual compounding. The interest-accumulated amount in the reserve will be used to retire the entire issue at its maturity 20 years hence. The Association plans to meet the payment requirements by selling season tickets at a \$10 net profit per ticket. How many tickets must be sold each year to service the debt (to meet the interest and principal repayment requirements)?

- a. 5,372
- b. 10,186
- c. 15,000
- d. 20,459
- e. 25,000

FV of an annuity**Answer: c Diff: T**

119. John and Julie Johnson are interested in saving for their retirement. John and Julie have the same birthday--both are 50 years old today. They started saving for their retirement on their 25th birthday, when they received a \$20,000 gift from Julie's aunt and deposited the money in an investment account. Every year thereafter, the couple added another \$5,000 to the account. (The first contribution was made on their 26th birthday and the 25th contribution was made today on their 50th birthday.) John and Julie estimate that they will need to withdraw \$150,000 from the account 3 years from now, to help meet college expenses for their 5 children. The couple plans to retire on their 58th birthday, 8 years from today. They will make a total of 8 more contributions, one on each of their next 8 birthdays with the last payment made on their 58th birthday. If the couple continues to contribute \$5,000 to the account on their birthday, how much money will be in the account when they retire? Assume that the investment account earns 12 percent a year.

- a. \$1,891,521
- b. \$2,104,873
- c. \$2,289,627
- d. \$2,198,776
- e. \$2,345,546

FV of an annuity**Answer: e Diff: T**

120. Carla is interested in saving for retirement. Today, on her 40th birthday, she has \$100,000 in her investment account. She plans to make additional contributions on each of her subsequent birthdays. Specifically, she plans to:
- Contribute \$10,000 per year each year during her 40's. (This will entail 9 contributions--the first will occur on her 41st birthday and the 9th on her 49th birthday.)
 - Contribute \$20,000 per year each year during her 50's. (This will entail 10 contributions--the first will occur on her 50th birthday and the 10th on her 59th birthday.)
 - Contribute \$25,000 per year thereafter until age 65. (This will entail 6 contributions--the first will occur on her 60th birthday and the 6th on her 65th birthday.)

Assume that her investment account has an expected return of 11 percent per year. If she sticks to her plan, how much will Carla have in her account on her 65th birthday after her final contribution?

- a. \$1,575,597
- b. \$2,799,513
- c. \$2,877,872
- d. \$2,909,143
- e. \$2,934,143

EAR and FV of annuity**Answer: c Diff: T N**

121. Today you opened up a local bank account. Your plan is make five \$1,000 contributions to this account. The first \$1,000 contribution will occur today and then every six months you will contribute another \$1,000 to the account. (So your final \$1,000 contribution will be made two years from today). The bank account pays a 6 percent nominal annual interest, and interest is compounded monthly. After two years, you plan to leave the money in the account earning interest, but you will not make any further contributions to the account. How much will you have in the account 8 years from today?

- a. \$7,092
- b. \$7,569
- c. \$7,609
- d. \$7,969
- e. \$8,070

FV of annuity due**Answer: a Diff: T**

122. To save money for a new house, you want to begin contributing money to a brokerage account. Your plan is to make 10 contributions to the brokerage account. Each contribution will be for \$1,500. The contributions will come at the beginning of each of the next 10 years. The first contribution will be made at $t = 0$ and the final contribution will be made at $t = 9$. Assume that the brokerage account pays a 9 percent return with quarterly compounding. How much money do you expect to have in the brokerage account nine years from now ($t = 9$)?

- a. \$23,127.49
- b. \$25,140.65
- c. \$25,280.27
- d. \$21,627.49
- e. \$19,785.76

FV of investment account**Answer: b Diff: T**

123. Kelly and Brian Johnson are a recently married couple whose parents have counseled them to start saving immediately in order to have enough money down the road to pay for their retirement and their children's college expenses. Today ($t = 0$) is their 25th birthday (the couple shares the same birthday).

The couple plan to have two children (Dick and Jane). Dick is expected to enter college 20 years from now ($t = 20$); Jane is expected to enter college 22 years from now ($t = 22$). So in years $t = 22$ and $t = 23$ there will be two children in college. Each child will take 4 years to complete college, and college costs are paid at the beginning of each year of college.

College costs per child will be as follows:

<u>Year</u>	<u>Cost per child</u>	<u>Children in college</u>
20	\$58,045	Dick
21	62,108	Dick
22	66,456	Dick and Jane
23	71,108	Dick and Jane
24	76,086	Jane
25	81,411	Jane

Kelly and Brian plan to retire 40 years from now at age 65 (at $t = 40$). They plan to contribute \$12,000 per year at the end of each year for the next 40 years into an investment account that earns 10 percent per year. This account will be used to pay for the college costs, and also to provide a nest egg for Kelly and Brian's retirement at age 65. How big will Kelly and Brian's nest egg (the balance of the investment account) be when they retire at age 65 ($t = 40$)?

- a. \$1,854,642
- b. \$2,393,273
- c. \$2,658,531
- d. \$3,564,751
- e. \$4,758,333

Effective annual rate**Answer: c Diff: T**

124. You have some money on deposit in a bank account that pays a nominal (or quoted) rate of 8.0944 percent, but with interest compounded daily (using a 365-day year). Your friend owns a security that calls for the payment of \$10,000 after 27 months. The security is just as safe as your bank deposit, and your friend offers to sell it to you for \$8,000. If you buy the security, by how much will the effective annual rate of return on your investment change?

- a. 1.87%
- b. 1.53%
- c. 2.00%
- d. 0.96%
- e. 0.44%

PMT and quarterly compounding**Answer: b Diff: T**

125. Your employer has agreed to make 80 quarterly payments of \$400 each into a trust account to fund your early retirement. The first payment will be made 3 months from now. At the end of 20 years (80 payments), you will be paid 10 equal annual payments, with the first payment to be made at the beginning of Year 21 (or the end of Year 20). The funds will be invested at a nominal rate of 8 percent, quarterly compounding, during both the accumulation and the distribution periods. How large will each of your 10 receipts be? (Hint: You must find the EAR and use it in one of your calculations.)

- a. \$ 7,561
- b. \$10,789
- c. \$11,678
- d. \$12,342
- e. \$13,119

Non-annual compounding**Answer: a Diff: T**

126. A financial planner has offered you three possible options for receiving cash flows. You must choose the option that has the highest present value.

- (1) \$1,000 now and another \$1,000 at the beginning of each of the 11 subsequent months during the remainder of the year, to be deposited in an account paying a 12 percent nominal annual rate, but compounded monthly (to be left on deposit for the year).
- (2) \$12,750 at the end of the year (assume a 12 percent nominal interest rate with semiannual compounding).
- (3) A payment scheme of 8 quarterly payments made over the next two years. The first payment of \$800 is to be made at the end of the current quarter. Payments will increase by 20 percent each quarter. The money is to be deposited in an account paying a 12 percent nominal annual rate, but compounded quarterly (to be left on deposit for the entire 2-year period).

Which one would you choose?

- a. Choice 1
- b. Choice 2
- c. Choice 3
- d. Either one, since they all have the same present value.
- e. Choice 1, if the payments were made at the end of each month.

Value of unknown withdrawal**Answer: d Diff: T**

127. Steve and Robert were college roommates, and each is celebrating their 30th birthday today. When they graduated from college nine years ago (on their 21st birthday), they each received \$5,000 from family members for establishing investment accounts. Steve and Robert have added \$5,000 to their separate accounts on each of their following birthdays (22nd through 30th birthdays). Steve has withdrawn nothing from the account, but Robert made one withdrawal on his 27th birthday. Steve has invested the money in Treasury bills that have earned a return of 6 percent per year, while Robert has invested his money in stocks that have earned a return of 12 percent per year. Both Steve and Robert have the same amount in their accounts today. How much did Robert withdraw on his 27th birthday?

- a. \$ 7,832.22
- b. \$ 8,879.52
- c. \$10,865.11
- d. \$15,545.07
- e. \$13,879.52

Breakeven annuity payment**Answer: a Diff: T N**

128. Linda needs a new car and she is deciding whether it makes sense to buy or lease the car. She estimates that if she buys the car it will cost her \$17,000 today ($t = 0$) and that she would sell the car four years from now for \$7,000 (at $t = 4$). If she were to lease the car she would make a fixed lease payment at the end of each of the next 48 months (4 years). Assume that the operating costs are the same regardless of whether she buys or leases the car. Assume that if she leases, there are no up-front costs and that there is no option to buy the car after four years. Linda estimates that she should use a 6 percent nominal interest rate to discount the cash flows. What is the breakeven lease payment? (That is, at what monthly lease payment would she be indifferent between buying and leasing the car?)

- a. \$269.85
- b. \$271.59
- c. \$275.60
- d. \$277.39
- e. \$279.83

Multiple Part:

(The following information applies to the next two problems.)

A 30-year, \$115,000 mortgage has a nominal annual rate of 7 percent. All payments are made at the end of each month.

Required mortgage payment**Answer: b Diff: E N**

129. What is the monthly payment on the mortgage?

- a. \$760.66
- b. \$765.10
- c. \$772.29
- d. \$774.10
- e. \$776.89

Remaining mortgage balance**Answer: e Diff: E N**

130. What is the remaining balance on the mortgage after 5 years?

- a. \$106,545.45
- b. \$106,919.83
- c. \$107,623.52
- d. \$107,988.84
- e. \$108,251.33

(The following information applies to the next two problems.)

Today is your 21st birthday and your parents gave you a gift of \$2,000. You just put this money in a brokerage account, and your plan is to add \$1,000 to the account each year on your birthday, starting on your 22nd birthday.

Time to accumulate a lump sum**Answer: d Diff: E N**

131. If you earn 10 percent a year in the brokerage account, what is the minimum number of whole years it will take for you to have at least \$1,000,000 in the account?

- a. 41
- b. 43
- c. 45
- d. 47
- e. 48

Required annual rate of return**Answer: c Diff: E N**

132. Assume that you want to have \$1,000,000 in the account by age 60 (39 years from today). What annual rate of return will you need to earn on your investments in order to reach this goal?

- a. 12.15%
- b. 12.41%
- c. 12.57%
- d. 12.66%
- e. 12.91%

(The following information applies to the next two problems.)

Your family recently bought a house. You have a \$100,000, 30-year mortgage with a 7.2 percent nominal annual interest rate. Interest is compounded monthly and all payments are made at the end of the month.

Monthly mortgage payments**Answer: c Diff: E N**

133. What is the monthly payment on the mortgage?

- a. \$639.08
- b. \$674.74
- c. \$678.79
- d. \$685.10
- e. \$691.32

Amortization**Answer: d Diff: M N**

134. What percentage of the total payments during the first three years is going towards the principal?

- a. 9.6%
- b. 10.3%
- c. 11.7%
- d. 12.9%
- e. 13.4%

(The following information applies to the next two problems.)

The Jordan family recently purchased their first home. The house has a 15-year (180-month), \$165,000 mortgage. The mortgage has a nominal annual interest rate of 7.75 percent. All mortgage payments are made at the end of the month.

Monthly mortgage payments**Answer: d Diff: E N**

135. What is the monthly payment on the mortgage?

- a. \$1,065.63
- b. \$1,283.61
- c. \$1,322.78
- d. \$1,553.10
- e. \$1,581.97

Remaining mortgage balance**Answer: c Diff: E N**

136. What will be the remaining balance on the mortgage after one year (right after the 12th payment has been made)?

- a. \$152,879.31
- b. \$155,362.50
- c. \$158,937.91
- d. \$160,245.39
- e. \$160,856.84

(The following information applies to the next two problems.)

Victoria and David have a 30-year, \$75,000 mortgage with an 8 percent nominal annual interest rate. All payments are due at the end of the month.

Amortization**Answer: d Diff: M N**

137. What percentage of their monthly payments the first year will go towards interest payments?
- a. 7.76%
 - b. 9.49%
 - c. 82.17%
 - d. 90.51%
 - e. 91.31%

Amortization**Answer: a Diff: E N**

138. If Victoria and David were able to refinance their mortgage and replace it with a 7 percent nominal annual interest rate, how much (in dollars) would their monthly payment decline?
- a. \$ 51.35
 - b. \$ 59.78
 - c. \$ 72.61
 - d. \$ 88.37
 - e. \$104.49

(The following information applies to the next two problems.)

Karen and Keith have a \$300,000, 30-year (360-month) mortgage. The mortgage has a 7.2 percent nominal annual interest rate. Mortgage payments are made at the end of each month.

Monthly mortgage payment**Answer: c Diff: E N**

139. What is the monthly payment on the mortgage?
- a. \$1,759.41
 - b. \$1,833.33
 - c. \$2,036.36
 - d. \$2,055.29
 - e. \$3,105.25

Amortization**Answer: b Diff: M N**

140. What percentage of the total payments the first year (the first twelve months) will go towards repayment of principal?
- a. 11.88%
 - b. 12.00%
 - c. 13.21%
 - d. 13.55%
 - e. 14.16%

(The following information applies to the next three problems.)

Bill and Paula just purchased a car. They financed the car with a four-year (48-month) \$15,000 loan. The loan is fully amortized after four years (i.e., the loan will be fully paid off after four years). Loan payments are due at the end of each month. The loan has a 12 percent nominal annual rate and the interest is compounded monthly.

Monthly loan payments

Answer: a Diff: E N

141. What are the monthly payments on the loan?

- a. \$395.01
- b. \$401.99
- c. \$409.16
- d. \$411.54
- e. \$418.16

Amortization

Answer: e Diff: M N

142. What percentage of the total payments the first two years are going towards repayment of principal?

- a. 44.1%
- b. 50.0%
- c. 55.9%
- d. 61.6%
- e. 69.7%

Effective annual rate

Answer: e Diff: E N

143. What is the effective annual rate on the loan? (Hint: Remember to switch your calculator back to P/YR = 1 after working this problem.)

- a. 12.36%
- b. 12.49%
- c. 12.55%
- d. 12.62%
- e. 12.68%

Web Appendix 6B

Multiple Choice: Problems

Easy:

PV continuous compounding

Answer: b Diff: E

6B-1. In six years' time, you are scheduled to receive money from a trust established for you by your grandparents. When the trust matures there will be \$100,000 in the account. If the account earns 9 percent compounded continuously, how much is in the account today?

- a. \$ 23,456
- b. \$ 58,275
- c. \$171,600
- d. \$ 59,627
- e. \$ 61,385

Medium:

FV continuous compounding

Answer: a Diff: M

6B-2. Assume one bank offers you a nominal annual interest rate of 6 percent compounded daily while another bank offers you continuous compounding at a 5.9 percent nominal annual rate. You decide to deposit \$1,000 with each bank. Exactly two years later you withdraw your funds from both banks. What is the difference in your withdrawal amounts between the two banks?

- a. \$ 2.25
- b. \$ 0.09
- c. \$ 1.12
- d. \$ 1.58
- e. \$12.58

Continuous compounded interest rate

Answer: a Diff: M

6B-3. In order to purchase your first home you need a down payment of \$19,000 four years from today. You currently have \$14,014 to invest. In order to achieve your goal, what nominal interest rate, compounded continuously, must you earn on this investment?

- a. 7.61%
- b. 7.26%
- c. 6.54%
- d. 30.56%
- e. 19.78%

Payment and continuous compounding**Answer: d Diff: M**

6B-4. You place \$1,000 in an account that pays 7 percent interest compounded continuously. You plan to hold the account exactly three years. Simultaneously, in another account you deposit money that earns 8 percent compounded semiannually. If the accounts are to have the same amount at the end of the three years, how much of an initial deposit do you need to make now in the account that pays 8 percent interest compounded semiannually?

- a. \$1,006.42
- b. \$ 986.73
- c. \$ 994.50
- d. \$ 975.01
- e. \$ 962.68

Continuous compounding**Answer: a Diff: M**

6B-5. You have the choice of placing your savings in an account paying 12.5 percent compounded annually, an account paying 12.0 percent compounded semiannually, or an account paying 11.5 percent compounded continuously. To maximize your return you would choose:

- a. 12.5% compounded annually
- b. 12.0% compounded semiannually
- c. 11.5% compounded continuously
- d. You would be indifferent since the effective rate for all three is the same.
- e. You would be indifferent between choices a and c since their effective rates are the same.

Continuous compounding**Answer: b Diff: M**

6B-6. You have \$5,438 in an account that has been paying an annual rate of 10 percent, compounded continuously. If you deposited some funds 10 years ago, how much was your original deposit?

- a. \$1,000
- b. \$2,000
- c. \$3,000
- d. \$4,000
- e. \$5,000

Continuous compounding**Answer: d Diff: M**

6B-7. For a 10-year deposit, what annual rate payable semiannually will produce the same effective rate as 4 percent compounded continuously?

- a. 2.02%
- b. 2.06%
- c. 3.95%
- d. 4.04%
- e. 4.12%

Continuous compounding

Answer: b Diff: M

6B-8. How much should you be willing to pay for an account today that will have a value of \$1,000 in 10 years under continuous compounding if the nominal rate is 10 percent?

- a. \$354
- b. \$368
- c. \$385
- d. \$376
- e. \$370

Continuous compounding

Answer: b Diff: M

6B-9. If you receive \$15,000 today and can invest it at a 5 percent annual rate compounded continuously, what will be your ending value after 20 years?

- a. \$35,821
- b. \$40,774
- c. \$75,000
- d. \$81,342
- e. \$86,750

CHAPTER 6

ANSWERS AND SOLUTIONS

1. **PV and discount rate** **Answer: a Diff: E**

2. **Time value concepts** **Answer: e Diff: E**

3. **Time value concepts** **Answer: d Diff: E**

Statements b and c are correct; therefore, statement d is the correct choice. The present value is smaller if interest is compounded monthly rather than semiannually.

4. **Time value concepts** **Answer: d Diff: E**

Statements a and b are correct; therefore, statement d is the correct choice. The nominal interest rate will be less than the effective rate when the number of periods per year is greater than one.

5. **Time value concepts** **Answer: e Diff: E**

As the effective rate is the same, the correct answer must be the one that has the largest amount of money compounding for the longest time. This would be statement e. The easiest way to see this is to assume an effective annual rate and then do the calculations:

Say the effective rate is 10 percent. For the semiannual investments, the nominal annual rate will be 9.76 percent. To calculate the FV for A, enter the following inputs into the calculator: $N = 10$; $I/YR = 9.76/2 = 4.88$; $PV = 0$; $PMT = 50$; and then solve for $FV = \$625.38$.

Repeat this for the other 4 investments, using a 10 percent effective annual rate for Investments D and E, and remembering to use BEGIN mode for Investments B and E. Investment E has the largest future value (\$671.56) using an effective annual rate of 10 percent.

6. **Effective annual rate** **Answer: b Diff: E**

The bank account that pays the highest nominal rate with the most frequent rate of compounding will have the highest EAR. Consequently, statement b is the correct choice.

7. **Effective annual rate** **Answer: d Diff: E**

Statement d is correct; the other statements are false. Looking at responses a through d, you should realize the choice with the greatest frequency of compounding will give you the highest EAR. This is statement d. Now, compare choices d and e. We know $EAR_d > 7.8\%$; therefore, statement d is the correct choice. The EAR of each of the statements is shown below.

$EAR_a = 8.30\%$; $EAR_b = 8\%$; $EAR_c = 8.24\%$; $EAR_d = 8.328\%$; $EAR_e = 7.8\%$.

8. Amortization Answer: b Diff: E

Statement b is true; the others are false. The remaining balance after three years will be \$100,000 less the total amount of repaid principal during the first 36 months. On a fixed-rate mortgage the monthly payment remains the same.

9. Amortization Answer: e Diff: E

Statements b and c are correct; therefore, statement e is the correct choice. Monthly payments will remain the same over the life of the loan.

10. Quarterly compounding Answer: e Diff: E

If the nominal rate is 8 percent and there is quarterly compounding, the periodic rate must be $8\%/4 = 2\%$. The effective rate will be greater than the nominal rate; it will be 8.24 percent. So the correct answer is statement e.

11. Annuities Answer: c Diff: M

By definition, an annuity due is received at the beginning of the year while an ordinary annuity is received at the end of the year. Because the payments are received earlier, both the present and future values of the annuity due are greater than those of the ordinary annuity.

12. Time value concepts Answer: e Diff: M

If the interest rate were higher, the payments would all be higher, and all of the increase would be attributable to interest. So, the proportion of each payment that represents interest would be higher. Note that statement b is false because interest during Year 1 would be the interest rate times the beginning balance, which is \$10,000. With the same interest rate and the same beginning balance, the Year 1 interest charge will be the same, regardless of whether the loan is amortized over 5 or 10 years.

13. Time value concepts Answer: e Diff: M

14. Time value concepts Answer: c Diff: M

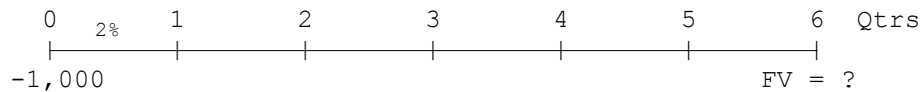
Statement c is correct; the other statements are false. The effective rate of the investment in statement a is 10.25%. The present value of the annuity due is greater than the present value of the ordinary annuity.

15. Time value concepts Answer: e Diff: T

16. FV of a sum

Answer: b Diff: E

Time Line:



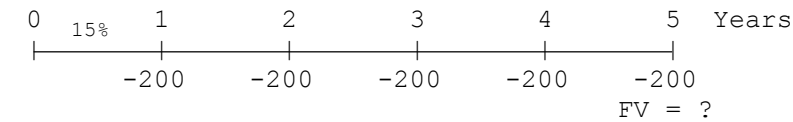
Financial calculator solution:

Inputs: $N = 6$; $I = 2$; $PV = -1000$; $PMT = 0$. Output: $FV = \$1,126.16 \approx \$1,126$.

17. FV of an annuity

Answer: e Diff: E

Time Line:



Financial calculator solution:

Inputs: $N = 5$; $I = 15$; $PV = 0$; $PMT = -200$. Output: $FV = \$1,348.48$.

18. FV of an annuity

Answer: a Diff: E N

The payments start next year, so the calculator should be in END mode. Enter the following data in your calculator:

N = 42; I/Yr = 12; PV = -1000; PMT = -2000. Then solve for FV = \$2,045,442.

19. FV of annuity due

Answer: d Diff: E N

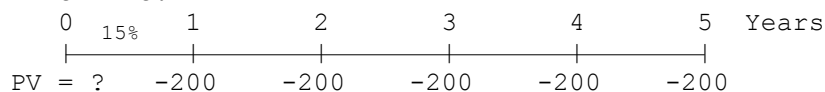
Since payments begin today and occur every year on Janet's birthday, the calculator must be set to BEGIN mode. Now, we just find the future value of these payments by entering the following data into your calculator:

BEG N = 42; I = 10; PV = 10000; PMT = 1000; and then solve for FV = \$1,139,037.68.

20. PV of an annuity

Answer: a Diff: E

Time Line:



Financial calculator solution:

Inputs: $N = 5$; $I = 15$; $PMT = -200$; $FV = 0$. Output: $PV = \$670.43$.

21. PV of a perpetuity

Answer: c Diff: E

$$V = \text{PMT}/i = \$1,000/0.15 = \$6,666.67.$$

22. PV of an uneven CF stream**Answer: b Diff: E**

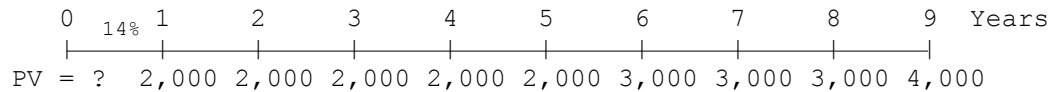
$$\begin{aligned}\text{NPV} &= \$10,000/1.08 + \$25,000/(1.08)^2 + \$50,000/(1.08)^3 + \$35,000/(1.08)^4 \\ &= \$9,259.26 + \$21,433.47 + \$39,691.61 + \$25,726.04 \\ &= \$96,110.38 \approx \$96,110.\end{aligned}$$

Financial calculator solution:

Using cash flows

Inputs: $CF_0 = 0$; $CF_1 = 10000$; $CF_2 = 25000$; $CF_3 = 50000$; $CF_4 = 35000$; $I = 8$.Output: $\text{NPV} = \$96,110.39 \approx \$96,110$.**23. PV of an uneven CF stream****Answer: c Diff: E**

Time Line:

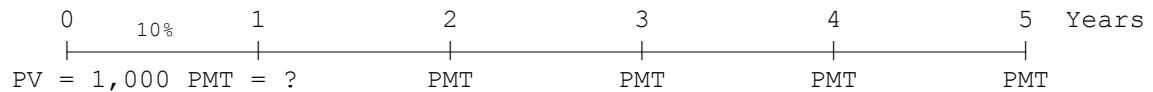


Financial calculator solution:

Using cash flows

Inputs: $CF_0 = 0$; $CF_1 = 2000$; $N_j = 5$; $CF_2 = 3000$; $N_j = 3$; $CF_3 = 4000$; $I = 14$.Output: $\text{NPV} = \$11,713.54 \approx \$11,714$.**24. Required annuity payments****Answer: b Diff: E**

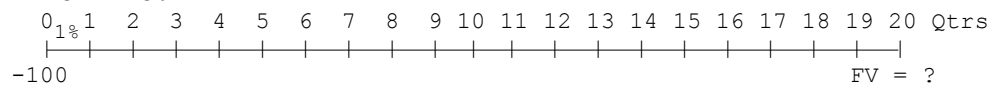
Time line:



Financial calculator solution:

Inputs: $N = 5$; $I = 10$; $PV = -1000$; $FV = 0$. Output: $\text{PMT} = \$263.80$.**25. Quarterly compounding****Answer: a Diff: E**

Time line:



Financial calculator solution:

Inputs: $N = 20$; $I = 1$; $PV = -100$; $\text{PMT} = 0$. Output: $\text{FV} = \$122.02$.**26. Growth rate****Answer: d Diff: E**

Time Line:

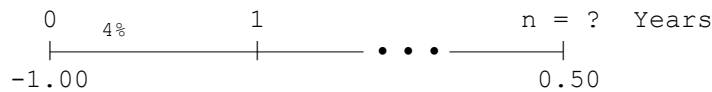


Financial calculator solution:

Inputs: $N = 30$; $PV = -1800$; $\text{PMT} = 0$; $FV = 13700$. Output: $I = 7.0\%$.

27. Effect of inflation**Answer: c Diff: E**

Time Line:

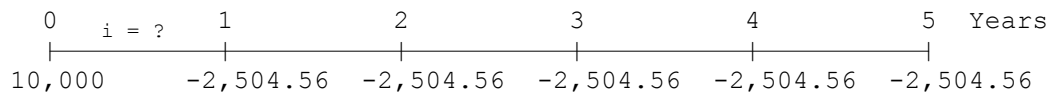


Financial calculator solution:

Inputs: I = 4; PV = -1; PMT = 0; FV = 0.50.

Output: N = -17.67 \approx 18 years.**28. Interest rate****Answer: b Diff: E**

Time Line:



Financial calculator solution:

Inputs: N = 5; PV = 10000; PMT = -2504.56; FV = 0. Output: I = 8%.

29. Effective annual rate**Answer: c Diff: E**

Bank A: 8%, monthly.

$$\begin{aligned} \text{EAR}_A &= \left(1 + \frac{k_{\text{Nom}}}{m}\right)^m - 1 \\ &= \left(1 + \frac{0.08}{12}\right)^{12} - 1 = 8.30\%. \end{aligned}$$

Bank B: 9%, interest due at end of year

$$\text{EAR}_B = 9\%.$$

$$9.00\% - 8.30\% = 0.70\%.$$

30. Effective annual rate**Answer: b Diff: E**

Use the formula for calculating effective rates from nominal rates as follows:

$$\text{EAR} = (1 + 0.18/12)^{12} - 1 = 0.1956 \text{ or } 19.56\%.$$

31. Effective annual rate**Answer: b Diff: E**

Convert each of the alternatives to an effective annual rate (EAR) for comparison. This problem can be solved with either the EAR formula or a financial calculator.

- a. EAR = 10.38%.
- b. EAR = 10.47%.
- c. EAR = 10.20%.
- d. EAR = 10.25%.
- e. EAR = 10.07%.

Therefore, the highest effective return is choice b.

32. Effective annual rate**Answer: c Diff: E**

Your proposal:

$$EAR_1 = \$120/\$1,000$$

$$EAR_1 = 12\%.$$

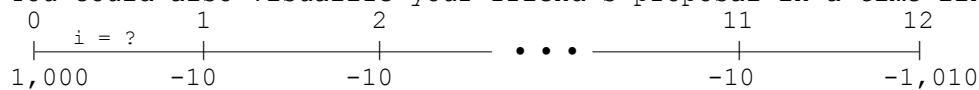
Your friend's proposal:

Interest is being paid each month ($\$10/\$1,000 = 1\%$ per month), so it compounds, and the EAR is higher than $k_{Nom} = 12\%$:

$$EAR_2 = \left(1 + \frac{0.12}{12}\right)^{12} - 1 = 12.68\%.$$

$$\text{Difference} = 12.68\% - 12.00\% = 0.68\%.$$

You could also visualize your friend's proposal in a time line format:



Insert those cash flows in the cash flow register of a calculator and solve for IRR. The answer is 1%, but this is a monthly rate. The nominal rate is $12(1\%) = 12\%$, which converts to an EAR of 12.68% as follows:

Input into a financial calculator the following:

P/YR = 12; NOM% = 12; and then solve for EFF% = 12.68%.

33. Effective annual rate**Answer: b Diff: E**

Enter the following inputs into the calculator: N = 10; PV = -35000; PMT = 0; FV = 100000; and then solve for I = 11.069% \approx 11.07%.

34. Effective annual rate**Answer: a Diff: E**

Convert each of the alternatives to an effective annual rate (EAR) for comparison. This problem can be solved with either the EAR formula or a financial calculator.

a. $EAR = 10.2736\%$.

b. $EAR = 10.1846\%$.

c. $EAR = 10.2000\%$.

d. $EAR = 10.2500\%$.

e. $EAR = 10.0339\%$.

Therefore, the highest effective return is choice a.

35. Effective annual rate **Answer: b Diff: E**

Convert each of the alternatives to an effective annual rate (EAR) for comparison. This problem can be solved with either the EAR formula or a financial calculator.

- a. EAR = 9.20%.
- b. EAR = 9.31%.
- c. EAR = 9.20%.
- d. EAR = 9.27%.
- e. EAR = 9.20%.

Thus, the highest effective return is choice b.

36. Nominal and effective rates **Answer: b Diff: E**

1st investment: Enter the following:
NOM% = 9; P/YR = 2; and then solve for EFF% = 9.2025%.

2nd investment: Enter the following:
EFF% = 9.2025; P/YR = 4; and then solve for NOM% = 8.90%.

37. Time for a sum to double **Answer: d Diff: E**

I = 7/12; PV = -1; PMT = 0; FV = 2; and then solve for N = 119.17 months
= 9.93 years.

38. Time for lump sum to grow **Answer: e Diff: E N**

Enter the data given in your financial calculator:
I = 10; PV = -300000; PMT = 0; FV = 1000000. Then solve for N = 12.63 years.

39. Time value of money and retirement **Answer: b Diff: E**

Step 1: Find the number of years it will take for each \$150,000 investment to grow to \$1,000,000.

BRUCE: I/YR = 5; PV = -150000; PMT = 0; FV = 1000000; and then solve for N = 38.88.

BRENDA: I/YR = 10; PV = -150000; PMT = 0; FV = 1000000; and then solve for N = 19.90.

Step 2: Calculate the difference in the length of time for the accounts to reach \$1 million:

Bruce will be able to retire in 38.88 years, or 38.88 - 19.90 = 19.0 years after Brenda does.

40. Monthly loan payments **Answer: c Diff: E**

First, find the monthly interest rate = $0.10/12 = 0.8333\%$ /month. Now, enter in your calculator N = 60; I/YR = 0.8333; PV = -13000; FV = 0; and then solve for PMT = \$276.21.

41. Remaining loan balance

Answer: a Diff: E

Step 1: Solve for the monthly payment:

Enter the following input data in the calculator:

$N = 60$; $I = 12/12 = 1$; $PV = -15000$; $FV = 0$; and then solve for $PMT = \$333.6667$.

Step 2: Determine the loan balance remaining after the 30th payment:

1 INPUT 30 ■ AMORT

= displays Int: \$3,621.1746

= displays Prin: \$6,388.8264

= displays Bal: \$8,611.1736.

Therefore, the balance will be \$8,611.17.

42. Remaining loan balance

Answer: b Diff: E

Find the payment of the mortgage first. $N = 48$; $I/YR = 12/12 = 1$; $PV = 20000$; $FV = 0$; and then solve for $PMT = \$526.68$.

Use the calculator's amortization feature to find the remaining loan balance:

3 years = $3 \times 12 = 36$ payments.

1 INPUT 36 ■ AMORT

= displays Int: \$4,888.07

= displays Prin: \$14,072.41

= displays Bal: \$5,927.59.

43. Remaining mortgage balance

Answer: c Diff: E

First, find the payment: Enter $N = 360$; $I/YR = 9/12 = 0.75$; $PV = -250000$; $FV = 0$; and then solve for $PMT = \$2,011.56$.

Use the calculator's amortization feature to find the remaining mortgage balance:

5 years = $5 \times 12 = 60$ payments.

1 INPUT 60 ■ AMORT

= displays Int: \$110,393.67

= displays Prin: \$10,299.93

= displays Bal: \$239,700.07.

44. Remaining mortgage balance

Answer: d Diff: E

Solve for the monthly payment as follows:

$N = 30 \times 12 = 360$; $I = 8/12 = 0.667$; $PV = -150000$; $FV = 0$; and then solve for $PMT = \$1,100.65/\text{month}$.

Use the calculator's amortization feature to find the remaining principal balance:

$3 \times 12 = 36$ payments

1 INPUT 36 ■ AMORT

= displays Int: \$35,543.52

= displays Prin: \$4,079.88

= displays Bal: \$145,920.12.

45. Remaining mortgage balance

Answer: d Diff: E

Solve for the monthly payment as follows:

$N = 12 \times 15 = 180$; $I = 8.5/12 = 0.7083$; $PV = -160000$; $FV = 0$; $PMT = \$1,575.58$.

Use the calculator's amortization feature to find the remaining principal balance:

1 INPUT 36 ■ AMORT

= displays Int: \$38,658.34

= displays Prin: \$18,062.54

= displays Bal: \$141,937.46.

46. Remaining mortgage balance

Answer: c Diff: E

Step 1: Calculate the monthly mortgage payment:

$N = 360$; $I = 7/12 = 0.5833$; $PV = -145000$; $FV = 0$; and then solve for $PMT = \$964.6886$.

Step 2: Develop the amortization schedule using the calculator's amortization feature:

$5 \times 12 = 60$ payments

1 INPUT 60 ■ AMORT

= displays Int: \$49,372.1225

= displays Prin: \$8,509.1935

= displays Bal: \$136,490.8065 \approx \$136,491.

47. Remaining mortgage balance

Answer: b Diff: E

Step 1: Calculate the mortgage's monthly payment:

Enter the following data in the calculator:

$N = 360$; $I = 7.45/12 = 0.6208$; $PV = -175000$; $FV = 0$; and then solve for $PMT = \$1,217.64$.

Step 2: Calculate the remaining balance on the mortgage after 60 monthly payments by using the calculator's amortization feature:

1 INPUT 60 ■ AMORT

= displays Int: \$63,556.53

= displays Prin: \$9,501.84

= displays Bal: \$165,498.16 \approx \$165,498.

48. Amortization

Answer: c Diff: E

Step 1: Determine the monthly payment of the mortgage:

Enter the following inputs in the calculator:

$N = 360$; $I = 8/12 = 0.6667$; $PV = -165000$; $FV = 0$; and then solve for $PMT = \$1,210.7115$.

Step 2: Determine the amount of interest during the first 3 years of the mortgage by using the calculator's amortization feature:

1 INPUT 36 ■ AMORT

= displays Int: \$39,097.8616.

49. FV under monthly compounding

Answer: a Diff: E N

Step 1: Make sure the interest rate matches the payment period. The payments are monthly, so you need to calculate the monthly periodic rate.

$$\text{Periodic rate} = 8\%/12 = 0.667\%.$$

Step 2: Enter the numbers given into your financial calculator:

$N = 30$; $I/Yr = 8/12 = 0.667$; $PV = 0$; $PMT = -200$. Then solve for $FV = \$6,617.77$.

50. Monthly vs. quarterly compounding

Answer: c Diff: M

There are several ways to do this, but the easiest is with the calculator:

Step 1: Find the effective rate on the account with monthly compounding:

$NOM\% = 5$; $P/YR = 12$; and then solve for $EFF\% = 5.1162\%$.

Step 2: Translate the effective rate to a nominal rate based on quarterly compounding:

$EFF\% = 5.1162$; $P/YR = 4$; and then solve for $NOM\% = 5.0209\% \approx 5.02\%$.

51. Present value

Answer: c Diff: M N

Use your financial calculator to determine each security's present value, and then choose the one with the largest present value.

a. Enter the following inputs in your calculator:

$N = 5$; $I = 8$; $PMT = 1000$; $FV = 0$; and then solve for $PV = \$3,992.71$.

b. Enter the following inputs in your calculator:

$N = 5$; $I = 8$; $PMT = 0$; $FV = 7000$; and then solve for $PV = \$4,764.08$.

c. $P = PMT/I = \$800/0.08 = \$10,000$.

d. Enter the following inputs in your calculator:

$N = 7$; $I = 8$; $PMT = 0$; $FV = 8500$; and then solve for $PV = \$4,959.67$.

e. Enter the following inputs in your calculator:

$CF_0 = 0$; $CF_1 = 1000$; $CF_2 = 2000$; $CF_3 = 3000$; $I = 8$; and then solve for $NPV = \$5,022.10$.

The preferred stock issue, statement c, has the largest present value among these choices.

52. PV under monthly compounding**Answer: b Diff: M**

Start by calculating the effective rate on the second security:

$P/YR = 12$; $NOM\% = 10$; and then solve for $EFF\% = 10.4713\%$.

Then, convert this effective rate to a semiannual rate:

$EFF\% = 10.4713$; $P/YR = 2$; $NOM\% = 10.2107\%$.

Now, calculate the value of the first security as follows:

$N = 10 \times 2 = 20$; $I = 10.2107/2 = 5.1054$; $PMT = 500$; $FV = 0$; and then solve for $PV = -\$6,175.82$.

53. PV under non-annual compounding**Answer: c Diff: M**

First, find the effective annual rate for a nominal rate of 12% with quarterly compounding: $P/YR = 4$; $NOM\% = 12$; and $EFF\% = 12.55\%$. In order to discount the cash flows properly, it is necessary to find the nominal rate with semiannual compounding that corresponds to the effective rate calculated above. Convert the effective rate to a semiannual nominal rate as $P/YR = 2$; $EFF\% = 12.55$; and $NOM\% = 12.18\%$. Finally, find the PV as $N = 2 \times 3 = 6$; $I = 12.18/2 = 6.09$; $PMT = 500$; $FV = 0$; and then solve for $PV = -\$2,451.73$.

54. PV of an annuity**Answer: a Diff: M**

Time Line:

	0	1	2	3	n = ? Years
		7%			
$PV_{Lifetime} = 100$		-	-	-	-
	10	10	10	10	10
$PV_{Annual} = 100$					

Financial calculator solution:

Inputs: $I = 7$; $PV = -90$; $PMT = 10$; $FV = 0$. Output: $N = 14.695 \approx 15$ years.

55. FV of an annuity**Answer: e Diff: M**

Step 1: Determine the effective annual rate:

The nominal rate is 6 percent, but we need the effective annual rate.

Using the calculator, input the following data:

$NOM\% = 6$; $P/YR = 365$; and then solve for $EFF\% = 6.1831\%$.

Step 2: Determine the future value of the annuity:

$N = 3$; $I/YR = 6.1831$; $PV = -500$; $PMT = -1000$; and then solve for $FV = \$3,787.92 \approx \$3,788$.

56. FV of an annuity**Answer: c Diff: M**

To calculate the solution to this problem, change your calculator to BEGIN mode. Then enter $N = 35$; $I = 10$; $PV = 0$; $PMT = 3000$; and then solve for $FV = \$894,380.4160$. Add the last payment of \$3,000, and the value at $t = 35$ is $\$897,380.4160 \approx \$897,380$.

57. FV of an annuity

Answer: d Diff: M N

First, find the present values today of the two withdrawals to occur on the 25th and 30th birthdays (in the 5th and 10th year of the problem, respectively).

PV today of \$5,000 withdrawal five years from now:

$N = 5$; $I = 12$; $PMT = 0$; $FV = 5000$; and then solve for $PV = -\$2,837.13$.

PV today of \$10,000 withdrawal 10 years from now:

$N = 10$; $I = 12$; $PMT = 0$; $FV = 10000$; and then solve for $PV = -\$3,219.73$.

Now, we subtract the PV of these withdrawals from our initial investment:

$\$5,000.00 - \$2,837.13 - \$3,219.73 = \$-1,056.86$.

Finally, we have our simple TVM setup with N , I , PV , and PMT , solving for FV :

$N = 45$; $I = 12$; $PV = -1056.86$; $PMT = 500$; and then solve for $FV = \$505,803.08 \approx \$505,803$.

58. FV of annuity due

Answer: d Diff: M

There are a few ways to do this. One way is shown below.

To get the value at $t = 5$ of the first 5 payments:

BEGIN mode, $N = 5$; $I = 11$; $PV = 0$; $PMT = -3000$; and then solve for $FV = \$20,738.58$.

Now add on to this the last payment that occurs at $t = 5$.

$\$20,738.58 + \$3,000 = \$23,738.58 \approx \$23,739$.

59. FV of annuity due

Answer: e Diff: M

Step 1: Calculate the value at $t = 45$ of the first 44 annuity contributions:

Enter the following inputs in the calculator:

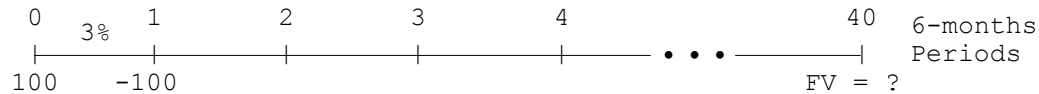
BEGIN mode, $N = 44$; $I = 10$; $PV = 0$; $PMT = -2000$; and then solve for $FV = \$1,435,809.67$.

Step 2: Now add on to the FV (calculated in Step 1) the last contribution that occurs at $t = 45$:

$\$1,435,809.67 + \$2,000.00 = \$1,437,809.67$.

60. **FV of a sum** **Answer: d Diff: M**

Time Line:



Step 1: Solve for amount on deposit at the end of 6 months:

$$\$100\left(1 + \frac{0.06}{2}\right) - \$100 = \$3.00.$$

Step 2: Calculate the ending balance 20 years after the initial deposit of \$100 was made:

Inputs: N = 39; I = 3; PV = -3.00; PMT = 0. Output: FV = \$9.50.

61. **FV under monthly compounding** **Answer: e Diff: M**

Financial calculator solution:

N = 3 × 12 = 36; I = 6/12 = 0.5; PV = -1000; PMT = 0; and then solve for FV = \$1,196.68.

62. **FV under monthly compounding** **Answer: d Diff: M**

Step 1: Calculate the FV at t = 3 of the first deposit.

Enter N = 36; I/YR = 12/12 = 1; PV = -10000; PMT = 0; and then solve for FV = \$14,308.

Step 2: Calculate the FV at t = 3 of the second deposit.

Enter N = 24; I/YR = 12/12 = 1; PV = -10000; PMT = 0; and then solve for FV = \$12,697.

Step 3: Calculate the FV at t = 3 of the third deposit.

Enter N = 12; I/YR = 12/12 = 1; PV = -20000; PMT = 0; and then solve for FV = \$22,537.

Step 4: The sum of the future values gives you the answer, \$49,542.

63. **FV under daily compounding** **Answer: a Diff: M**

Solve for FV as N = 132; I = 4/365 = 0.0110; PV = -2000; PMT = 0; and then solve for FV = \$2,029.14.

64. **FV under daily compounding** **Answer: d Diff: M N**

Step 1: Find the effective rate by entering the following data in your calculator:

I = 6; P/Yr = 365; and then solve for EFF = 6.1831%.

Step 2: Switch back to P/Yr = 1 and find the future value of the deposit by entering the following data in your calculator:

N = 5; I = 6.1831; PV = -1000; PMT = 0; and then solve for FV = \$1,349.82.

65. FV under non-annual compounding

Answer: d Diff: M

First, find the FV of Josh's savings as: $N = 2 \times 26 = 52$; $I = 10/26 = 0.3846$; $PV = 0$; $PMT = -100$; and $FV = \$5,744.29$.

John's savings will have two components, a lump sum contribution of \$1,500 and his monthly contributions. The FV of his regular savings is: $N = 2 \times 12 = 24$; $I = 10/12 = 0.8333$; $PV = 0$; $PMT = -150$; and $FV = \$3,967.04$. The FV of his previous savings is: $N = 24$; $I = 0.8333$; $PV = -1500$; $PMT = 0$; and $FV = \$1,830.59$.

Summing the components of John's savings yields \$5,797.63, which is greater than Josh's total savings. Thus, the most expensive car purchased costs \$5,797.63.

66. FV under quarterly compounding

Answer: c Diff: M

The effective rate is given by:

$NOM\% = 8$; $P/YR = 4$; and then solve for $EFF\% = 8.2432\%$.

The nominal rate on a semiannual basis is given by:

$EFF\% = 8.2432$; $P/YR = 2$; and then solve for $NOM\% = 8.08\%$.

The future value is given by:

$N = 2.5 \times 2 = 5$; $I = 8.08/2 = 4.04$; $PV = 0$; $PMT = -100$; and then solve for $FV = \$542.07$.

67. FV under quarterly compounding

Answer: d Diff: M

There are several ways of doing this. One way is:

First, find the periodic (quarterly) rate is $7\%/4 = 1.75\%$.

Next, find the future value of each amount put in the account:

$N = 12$; $I = 1.75$; $PV = -1000$; $PMT = 0$; and then solve for $FV = \$1,231.4393$. $N = 8$; $I = 1.75$; $PV = -2000$; $PMT = 0$; and then solve for $FV = \$2,297.7636$. $N = 4$; $I = 1.75$; $PV = -3000$; $PMT = 0$; and then solve for $FV = \$3,215.5771$.

Add up the future values for the answer: $\$6,744.78$.

Answer: c Diff: M N

$$\begin{aligned}\text{EFF}\% &= (1 + k_{\text{NOM}}/m)^m - 1 \\ &= (1 + 9\%/4)^4 - 1 \\ &= (1.0225)^4 - 1 \\ &= 1.09308 - 1 \\ &= 9.308\%.\end{aligned}$$
$$\begin{aligned} 9.308\% &= (1 + \kappa_{\text{NOM}}/12)^{12} - 1 \\ 1.09308 &= (1 + \kappa_{\text{NOM}}/12)^{12} \\ 1.00744 &= 1 + \kappa_{\text{NOM}}/12 \\ 0.00744 &= \kappa_{\text{NOM}}/12 \\ 0.08933 &= \kappa_{\text{NOM}}. \end{aligned}$$

Step 2: $EFF\% = 9.30833$; $P/YR = 12$; and then solve for $NOM\% = 8.933\%$.

Answer: e Diff: M

$PMT_0 = \$5000$, $PMT_1 = \$5500$, $PMT_2 = \$6050$, $PMT_3 = \$6655$, $PMT_4 = \$7320.50$. Then, find the future value of each payment at $t = 5$: For PMT_0 , $N = 5$; $I = 14$; $PV = -5000$; $PMT = 0$; thus, $FV = \$9,627.0729$. Similarly, for PMT_1 , $FV = \$9,289.2809$, for PMT_2 , $FV = \$8,963.3412$, for PMT_3 , $FV = \$8,648.8380$, and for PMT_4 , $FV = \$8,345.3700$. Finally, summing the future values of the respective payments will give the balance in the account at $t = 5$ or $\$44,873.90$.

Answer: d Diff: M

Timeline diagram showing cash flows over 10 years:

- Year 0: Cash outflow of 5,000.
- Year 1: Cash inflow of 1,000.
- Year 5: Cash inflow of 1,000.
- Year 6: Cash inflow of 2,000.
- Year 10: Final Value (FV) = ?

Output: $FV = \$31,147.79 \approx \$31,148.$

71. FV of an uneven CF stream**Answer: c Diff: M N**

The easiest way to find the solution to this problem is to find the PV of all her contributions today, and then find the FV of that PV 10 years from now.

Step 1: Calculate the PV of all the deposits today:

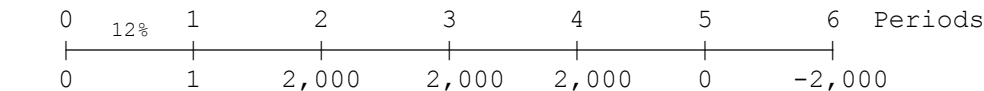
$CF_0 = 10000$; $CF_1 = 20000$; $CF_2 = 50000$; $I = 6$; and then solve for NPV = \$73,367.74653.

Step 2: Calculate the FV 10 years from now of the PV of the deposits:

$N = 10$; $I = 6$; $PV = -73367.74653$; $PMT = 0$; and then solve for FV = \$131,390.46.

72. PV of an uneven CF stream**Answer: a Diff: M**

Time Line:



PV = ?

Financial calculator solution:

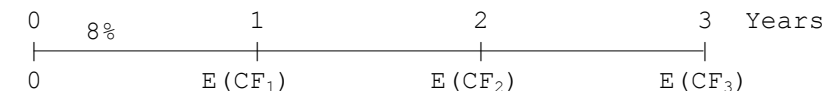
Using cash flows

Inputs: $CF_0 = 0$; $CF_1 = 1$; $CF_2 = 2000$; $N_j = 3$; $CF_3 = 0$; $CF_4 = -2000$; $I = 12$.

Output: NPV = \$3,276.615 \approx \$3,277.

73. PV of uncertain cash flows**Answer: e Diff: M**

Time Line:



Calculate expected cash flows

$E(CF_1) = (0.30)(\$300) + (0.40)(\$500) + (0.30)(\$700) = \500 .

$E(CF_2) = (0.15)(\$100) + (0.35)(\$200) + (0.35)(\$600) + (0.15)(\$900) = \$430$.

$E(CF_3) = (0.25)(\$200) + (0.75)(\$800) = \$650$.

Financial calculator solution:

Using cash flows

Inputs: $CF_0 = 0$; $CF_1 = 500$; $CF_2 = 430$; $CF_3 = 650$; $I = 8$.

Output: NPV = \$1,347.61.

74. Value of missing cash flow**Answer: d Diff: M**

Financial calculator solution:

Enter the first 4 cash flows, enter $I = 15$, and solve for NPV = -\$58.945.

The future value of \$58.945 will be the required cash flow.

$N = 4$; $I/YR = 15$; $PV = -58.945$; $PMT = 0$; and then solve for FV = \$103.10.

75. Value of missing cash flow

Answer: c Diff: M

Find the present value of each of the cash flows:

PV of $CF_1 = \$325/1.12 = \290.18 . PV of $CF_2 = \$400/(1.12)^2 = \318.88 .
PV of $CF_3 = \$550/(1.12)^3 = \391.48 . PV of $CF_5 = \$750/(1.12)^5 = \425.57 .
PV of $CF_6 = \$800/(1.12)^6 = \405.30 . Summing these values you obtain
\$1,831.41. The present value of CF_4 must then be $\$2,566.70 - \$1,831.41$
 $= \$735.29$. The value of CF_4 is $(\$735.29)(1.12)^4 = \$1,157$.

Financial calculator solution:

Using cash flows

Inputs: $CF_0 = -2566.70$; $CF_1 = 325$; $CF_2 = 400$; $CF_3 = 550$; $CF_4 = 0$; $CF_5 = 750$; $CF_6 = 800$; $I = 12$.

Output: NPV = -735.29.

The value of CF_4 is $(\$735.29)(1.12)^4 = \$1,157$.

76. Value of missing payments

Answer: d Diff: M

Find the FV of the price and the first three cash flows at $t = 3$.

To do this first find the present value of them.

$CF_0 = -5544.87$; $CF_1 = 100$; $CF_2 = 500$; $CF_3 = 750$; $I = 9$; and then solve
for NPV = $-\$4,453.15$.

Find the FV of this present value.

$N = 3$; $I = 9$; $PV = -4453.15$; $PMT = 0$; $FV = \$5,766.96$.

Now solve for X.

$N = 17$; $I = 9$; $PV = -5766.96$; $FV = 0$; and then solve for $PMT = \$675$.

77. Value of missing payments

Answer: c Diff: M

There are several different ways of doing this. One way is:

Find the future value of the first three years of the investment at Year 3.
 $N = 3$; $I = 7.3$; $PV = -24307.85$; $PMT = 2000$; $FV = \$23,580.68$.

Find the value of the final \$10,000 at Year 3.

$N = 7$; $I = 7.3$; $PMT = 0$; $FV = 10000$; $PV = -\$6,106.63$.

Add the two Year 3 values (remember to keep the signs right).

$\$23,580.68 + -\$6,106.63 = \$17,474.05$.

Now solve for the PMTs over years 4 through 9 (6 years) that have a PV
of \$17,474.05.

$N = 6$; $I = 7.3$; $PV = -17474.05$; $FV = 0$; $PMT = \$3,700.00$.

78. Value of missing payments**Answer: d Diff: M**

The project's cost should be the PV of the future cash flows. Use the cash flow key to find the PV of the first 3 years of cash flows.

$CF_0 = 0$; $CF_1 = 100$; $CF_2 = 200$; $CF_3 = 300$; $I/YR = 10$; $NPV = \$481.59$.

The PV of the cash flows for Years 4-20 must be:
 $\$3,000 - \$481.59 = \$2,518.41$.

Take this PV amount forward to Time 3:

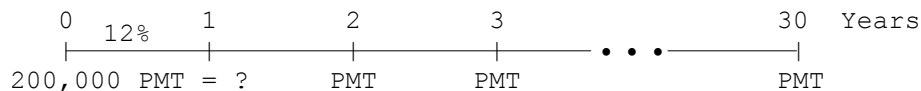
$N = 3$; $I/YR = 10$; $PV = -2518.41$; $PMT = 0$; and then solve for $FV = \$3,352.00$.

This amount is also the present value of the 17-year annuity.

$N = 17$; $I/YR = 10$; $PV = -3352$; $FV = 0$; and then solve for $PMT = \$417.87$.

79. Amortization**Answer: c Diff: M**

Time Line:



Financial calculator solution:

Inputs: $N = 30$; $I = 12$; $PV = -200000$; $FV = 0$.

Output: $PMT = \$24,828.73 \approx \$24,829$.

80. Amortization**Answer: a Diff: M**

Given: Loan value = \$100,000; Repayment period = 12 months; Monthly payment = \$9,456.

$N = 12$; $PV = -100000$; $PMT = 9456$; $FV = 0$; and then solve for $I/YR = 2.00\% \times 12 = 24.00\%$.

To find the amount of principal paid in the third month (or period), use the calculator's amortization feature.

3 INPUT 3 ■ AMORT

= displays Int: \$1,698.84

= displays Prin: \$7,757.16

= displays Bal: \$77,181.86.

81. Amortization**Answer: c Diff: M**

Enter the following inputs in the calculator:

$N = 30 \times 12 = 360$; $I = 9/12 = 0.75$; $PV = -90000$; $FV = 0$; $PMT = \$724.16$.

Total payments in the first 2 years are $\$724.16 \times 24 = \$17,379.85$.

Use the calculator's amortization feature:

$12 \times 2 = 24$ payments

1 INPUT 24 ■ AMORT

= displays Int: $\$16,092.44$.

Percentage of first two years that is interest is:

$\$16,092.44/\$17,379.85 = 0.9259 = 92.59\%$.

82. Amortization**Answer: e Diff: M**

Step 1: Calculate the monthly mortgage payment:

Enter the following inputs in the calculator:

$N = 360$; $I = 7.25/12 = 0.604167$; $PV = -135000$; $FV = 0$; and then solve for $PMT = \$920.9380$.

Step 2: Obtain the amortization schedule for the fourth year (months 37-48) by using the calculator's amortization feature:

37 INPUT 48 ■ AMORT

= displays Int: $\$9,428.2512$

= displays Prin: $\$1,623.0048$.

Step 3: Calculate the percentage of payments in the fourth year that will go towards the repayment of principal:

$\$1,623.0048/(\$920.938 \times 12) = 0.1469 = 14.69\%$.

83. Amortization**Answer: b Diff: M**

Step 1: Determine the monthly mortgage payment:

Enter the following data in the calculator:

$N = 360$; $I = 7/12 = 0.5833$; $PV = -125000$; $FV = 0$; and then solve for $PMT = \$831.6281$.

Step 2: Determine the total principal paid by using the calculator's amortization feature:

1 INPUT 36 ■ AMORT

= displays Int: $\$25,847.316$

= displays Prin: $\$4,091.295$

= displays Bal: $\$120,908.705$.

Step 3: Calculate the portion of mortgage payments that has gone towards repayment of principal:

Total amount of mortgage payments made in the first 3 years = $\$831.6281 \times 36 = \$29,938.612$. Repayment of principal portion: $\$4,091.295/\$29,938.612 = 13.67\%$.

84. Amortization**Answer: b Diff: M N**

Step 1: Calculate the monthly mortgage payment by entering the following inputs in your calculator:

$N = 180$; $I = 8/12 = 0.6667$; $PV = -250000$; $FV = 0$; and then solve for $PMT = \$2,389.1302$.

Step 2: Find the annual mortgage payments.

Annual = $\$2,389.1302 \times 12 = \$28,669.5625$.

Step 3: Find the amount that went towards principal in the 5th year with your calculator's amortization feature:

49 INPUT 60 ■ AMORT
= displays Int: \$16,295.9719
= displays Prin: \$12,373.5905
= displays Bal: \$196,915.6510.

Step 4: The portion of the mortgage payments that goes towards repayment of principal is:

$\$12,373.5905 / \$28,669.5625 = 43.16\%$.

85. Remaining mortgage balance**Answer: b Diff: M N**

Step 1: Find the monthly mortgage payment by entering the following inputs in your calculator:

$N = 360$; $I/Yr = 8/12 = 0.667$; $PV = -300000$; $FV = 0$; and then solve for $PMT = \$2,201.29$.

Step 2: Calculate the remaining principal balance after 5 years by using your financial calculator's amortization feature.

60 INPUT ■ AMORT
= displays Int: \$1,903.38
= displays Prin: \$297.91
= displays Bal: \$285,209.57.

86. Remaining loan balance**Answer: d Diff: M**

Step 1: Calculate the common monthly payment using the information you know about Jamie's loan:

$N = 48$; $I = 12/12 = 1$; $PV = -15000$; $FV = 0$; and then solve for $PMT = \$395.0075$.

Step 2: Calculate how much Jake's car cost using the information you know about his loan and the monthly payment solved in Step 1:

$N = 60$; $I = 12/12 = 1$; $PMT = -395.0075$; $FV = 0$; and then solve for $PV = \$17,757.5787$.

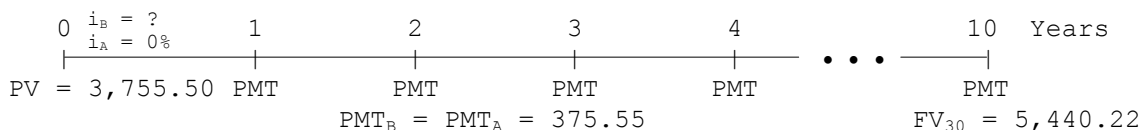
Step 3: Calculate the balance on Jake's loan at the end of 48 months by using the calculator's amortization feature:

1 INPUT 48 ■ AMORT
= displays Int: \$5,648.62
= displays Prin: \$13,311.74
= displays Bal: \$4,445.84.

87. Effective annual rate

Answer: b Diff: M

Time Line:



Financial calculator solution:

Calculate the PMT of the annuity

Inputs: N = 10; I = 0; PV = -3755.50; FV = 0. Output: PMT = \$375.55.

Calculate the effective annual interest rate

Inputs: N = 10; PV = 0; PMT = -375.55; FV = 5440.22.

Output: I = 7.999 \approx 8.0%.

88. Effective annual rate

Answer: d Diff: M

$$EAR_{Qtr} = \left(1 + \frac{0.10}{4}\right)^4 - 1 = 10.38\%.$$

$$EAR_{Dly} = \left(1 + \frac{0.09}{365}\right)^{365} - 1 = 9.42\%.$$

Difference = 10.38% - 9.42% = 0.96%.

89. Effective annual rate

Answer: e Diff: M

Given: Loan value = \$12,000; Loan term = 10 years (120 months); Monthly payment = \$150.

N = 120; PV = -12000; PMT = 150; FV = 0; and then solve for I/YR = 0.7241 \times 12 = 8.6892%. However, this is a nominal rate. To find the effective rate, enter the following:

NOM% = 8.6892; P/YR = 12; and then solve for EFF% = 9.0438%.

90. Nominal vs. effective annual rate

Answer: b Diff: M N

This is a question that requires you to be able to use your calculator to find effective and nominal rates.

Change to 4 \blacksquare P/YR; \blacksquare NOM% = 7.5; and then solve for \blacksquare EFF% = 7.7136%.

This is the effective rate of the Gilhart investment. Remember, that the effective rates on the two securities are equal. So, we can solve for the nominal annual return of the Olsen security.

Change to 12 \blacksquare P/YR; \blacksquare EFF% = 7.7136; and then solve for \blacksquare NOM% = 7.4536% \approx 7.45%.

91. Effective annual rate and annuities**Answer: d Diff: M**

Step 1: Find the effective annual rate:

Enter the following input data in the calculator:

NOM% = 9; P/YR = 12; and then solve for EFF% = 9.3807%.

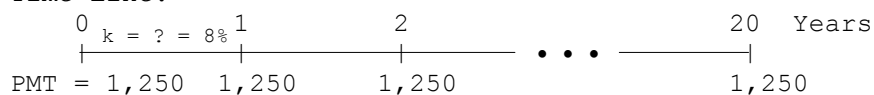
Step 2: Calculate the FV of the \$5,000 annuity at the end of 10 years:

Now, put the calculator in End mode, switch back to 1 P/Yr, and enter the following input data in the calculator:

N = 10; I = 9.3807; PV = 0; PMT = -5000; and then solve for FV = \$77,358.80 ≈ \$77,359.

92. Value of a perpetuity**Answer: c Diff: M**

Time Line:



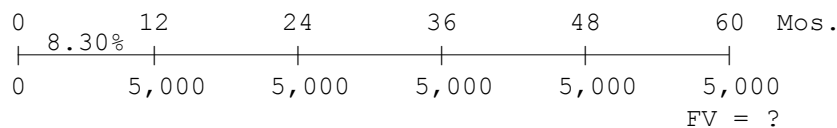
Solve for required return, k . We know $V_p = \frac{PMT}{k}$, thus,

$$k = \frac{PMT}{V_p} = \frac{\$1,250}{\$15,625} = 8\%.$$

Financial calculator solution:

Inputs: N = 20; I = 8; PMT = -1250; FV = 0.

Output: PV = \$12,272.68 ≈ \$12,273.

93. EAR and FV of an annuity**Answer: b Diff: M**

Step 1: Because the interest is compounded monthly, but payments are made annually, you need to find the interest rate for the payment period (the effective rate for one year).

Enter the following input data in your calculator:

NOM% = 8; P/YR = 12; EFF% = 8.30%.

Now use this rate as the interest rate. Remember to switch back P/YR = 1.

Step 2: Find the FV of the annuity:

N = 5; I = 8.30; PV = 0; PMT = -5000; and then solve for FV = \$29,508.98.

94. Required annuity payments

Answer: c Diff: M

Enter CFs:

$CF_0 = 0$; $CF_1 = 1.2$; $CF_2 = 1.6$; $CF_3 = 2.0$; $CF_4 = 2.4$; $CF_5 = 2.8$.

$I = 10$; NPV = \$7.2937 million.

$\$1 + \$7.2937 = \$8.2937$ million.

Now, calculate the annual payments:

BEGIN mode, $N = 5$; $I/YR = 10$; $PV = -8.2937$; $FV = 0$; and then solve for $PMT = \$1.989$ million.

95. Required annuity payments

Answer: b Diff: M

Step 1: Work out how much Karen will have saved by age 65:

Enter the following inputs in the calculator:

$N = 41$; $I = 10$; $PV = 0$; $PMT = 5000$; and then solve for $FV = \$2,439,259$.

Step 2: Figure the payments Kathy will need to make to have the same amount saved as Karen:

Enter the following inputs in the calculator:

$N = 36$; $I = 10$; $PV = 0$; $FV = 2439259$; and then solve for $PMT = \$8,154.60$.

96. Required annuity payments

Answer: c Diff: M

Step 1: Figure out how much their house will cost when they buy it in 5 years:

Enter the following input data in the calculator:

$N = 5$; $I = 3$; $PV = -120000$; $PMT = 0$; and then solve for $FV = \$139,112.89$.

This is how much the house will cost.

Step 2: Determine the maximum mortgage they can get, given that the nominal interest rate will be 7 percent, it is a 360-month mortgage, and the payments will be \$500:

$N = 360$; $I = 7/12 = 0.5833$; $PMT = -500$; $FV = 0$; and then solve for $PV = \$75,153.78$.

This is the PV of the mortgage (that is, the total amount they can borrow).

Step 3: Determine the down payment needed:

House prices are \$139,112.89, and they can borrow only \$75,153.78. This means the down payment will have to be:

Down payment = $\$139,112.89 - \$75,153.78 = \$63,959.11$.

This is the amount they will have to save to buy their house.

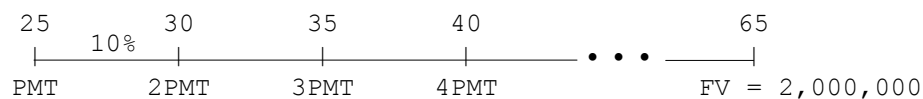
Step 4: Determine how much they need to deposit each year to reach this goal:

$N = 5$; $I = 10$; $PV = -2000$; $FV = 63959.11$; and then solve for $PMT = \$9,948.75 \approx \$9,949$.

97. Required annuity payments

Answer: a Diff: M N

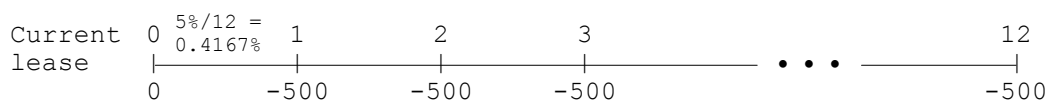
Here's a time line depicting the problem:



$$\begin{aligned}
 \$2,000,000 &= \text{PMT}(1.10)^{40} + 2\text{PMT}(1.10)^{35} + 3\text{PMT}(1.10)^{30} + 4\text{PMT}(1.10)^{25} \\
 \$2,000,000 &= 45.259256\text{PMT} + 56.204874\text{PMT} + 52.348207\text{PMT} + 43.338824\text{PMT} \\
 \$2,000,000 &= 197.15116\text{PMT} \\
 \$10,144.50 &= \text{PMT} \\
 \text{PMT} &\approx \$10,145.
 \end{aligned}$$

98. NPV and non-annual discounting

Answer: b Diff: M



Inputs	12	5/12 = 0.4167	500	0
	<div style="border: 1px solid black; padding: 5px; display: inline-block;">N</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">I</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">PV</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">PMT</div>
			<div style="border: 1px solid black; padding: 5px; display: inline-block;">PMT</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">FV</div>

Output = -5,840.61



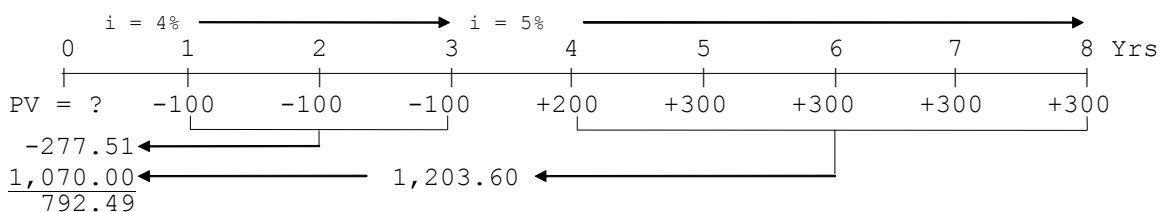
$CF_0 = 0$; $CF_{1-3} = 0$; $CF_{4-12} = -700$; $I = 0.4167$; and then solve for NPV = $-\$6,094.23$.

Therefore, the PV of payments under the proposed lease would be greater than the PV of payments under the old lease by $\$6,094.23 - \$5,840.61 = \$253.62$. Thus, your net worth would decrease by $\$253.62$.

99. PV of an uneven CF stream

Answer: c Diff: T

Time Line:



Financial calculator solution:

Inputs: $CF_0 = 0$; $CF_1 = -100$; $N_j = 3$; $I = 4$.

Output: NPV = -277.51.

Calculate the PV of CFs 4-8 as of time = 3 at $i = 5\%$

Inputs: $CF_0 = 0$; $CF_1 = 200$; $CF_2 = 300$; $N_j = 4$; $I = 5$.

Output: $NPV_3 = \$1,203.60$.

Calculate PV of the FV of the positive CFs at time = 3

Inputs: $N = 3$; $I = 4$; $PMT = 0$; $FV = -1203.60$.

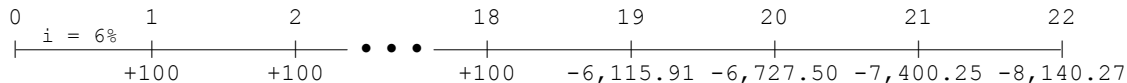
Output: PV = \$1,070.

Total PV = \$1,070 - \$277.51 = \$792.49.

100. PV of an uneven CF stream

Answer: d Diff: T

Time Line:



-\$8,554.84 PV of health care costs

1,082.76 PV of parents' savings

-7,472.08 Lump sum government must set aside

Find the present value of parent's savings: $N = 18$; $I = 6$; $PMT = -100$; $FV = 0$; and then solve for $PV = \$1,082.76$.

Health care costs, Years 19-22: $-\$1,000(1.1)^{19} = -\$6,115.91$; $-\$1,000(1.1)^{20} = -\$6,727.50$; $-\$1,000(1.1)^{21} = -\$7,400.25$; $-\$1,000(1.1)^{22} = -\$8,140.27$.

Find the present value of health care costs: $CF_0 = 0$; $CF_{1-18} = 0$; $CF_{19} = -6115.91$; $CF_{20} = -6727.50$; $CF_{21} = -7400.25$; $CF_{22} = -8140.27$; $I = 6$; and then solve for $NPV = -8,554.84 = PV$ of health care costs.

Consequently, the government must set aside $\$8,554.84 - \$1,082.76 = \$7,472.08$.

101. Required annuity payments**Answer: b Diff: T**

College cost today = \$10,000, Inflation = 5%. $CF_0 = \$10,000 \times (1.05)^5 = \$12,762.82 \times 1 = \$12,762.82$; $CF_1 = \$10,000 \times (1.05)^6 = \$13,400.96 \times 1 = \$13,400.96$; $CF_2 = \$10,000 \times (1.05)^7 = \$14,071.00 \times 2 = \$28,142.00$; $CF_3 = \$10,000 \times (1.05)^8 = \$14,774.55 \times 2 = \$29,549.10$; $CF_4 = \$10,000 \times (1.05)^9 = \$15,513.28 \times 1 = \$15,513.28$; $CF_5 = \$10,000 \times (1.05)^{10} = \$16,288.95 \times 1 = \$16,288.95$.

Financial calculator solution:

Enter cash flows in CF register; $I = 8$; solve for NPV = \$95,244.08.

Calculate annuity:

$N = 5$; $I = 8$; $PV = -50000$; $FV = 95244.08$; and then solve for $PMT = \$3,712.15$.

102. Required annuity payments**Answer: b Diff: T**

Step 1: Calculate the present value of college costs at $t = 16$ (Treat $t = 16$ as Year 0.):

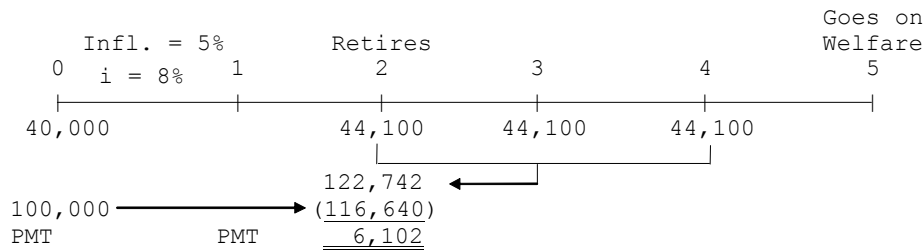
Remember, costs are incurred at end of year.

$CF_0 = 25000$; $CF_1 = 25000$; $CF_2 = 50000$; $CF_3 = 50000$; $CF_4 = 25000$; $CF_5 = 25000$; $I = 8$; and then solve for NPV = \$166,097.03.

Step 2: Calculate the annual required deposit:

$N = 16$; $I = 8$; $PV = 0$; $FV = -166097.03$; then solve for $PMT = \$5,477.36$.

Answer: c Diff: T



Step 1: The retirement payments, which begin at $t = 2$, must be:
 $\$40,000(1 + \text{Infl.})^2 = \$40,000(1.05)^2 = \$44,100.$

Step 2: There will be 3 retirement payments of \$44,100, made at $t = 2$, $t = 3$, and $t = 4$. We find the PV of an annuity due at $t = 2$ as follows: Set calculator to Begin mode. Then enter:
N = 3; I = 8; PMT = 44100; FV = 0; and then solve for PV = \$122,742. If he has this amount at $t = 2$, he can receive the 3 retirement payments.

Step 3: The \$100,000 now on hand will compound at 8% for 2 years:
 $\$100,000(1.08)^2 = \$116,640$.

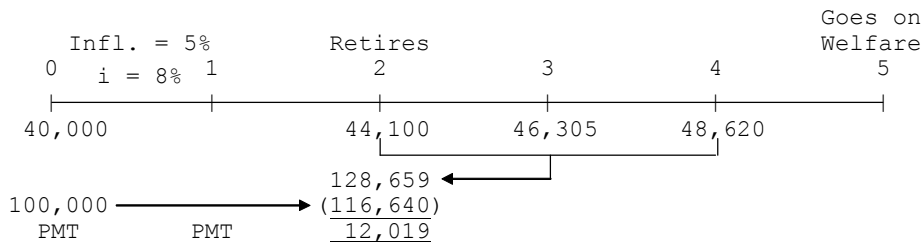
Step 4: So, he must save enough each year to accumulate an additional \$122,742 - \$116,640 = \$6,102:

Need at t = 2	\$122,742
Will have	(<u>116,640</u>)
Net additional needed	<u>\$ 6,102</u>

Step 5: He must make 2 payments, at $t = 0$ and at $t = 1$, such that they will grow to a total of \$6,102 at $t = 2$.
This is the FV of an annuity due found as follows:
Set calculator to Begin mode. Then enter:
 $N = 2$; $I = 8$; $PV = 0$; $FV = 6102$; and then solve for $PMT = \$2,716$.

104. Required annuity payments

Answer: d Diff: T



Step 1: The retirement payments, which begin at $t = 2$, must be:

$$t = 2: \$40,000(1.05)^2 = \$44,100.$$

$$t = 3: \$44,100(1.05) = \$46,305.$$

$$t = 4: \$46,305(1.05) = \$48,620.$$

Step 2: Now we need enough at $t = 2$ to make the 3 retirement payments as calculated in Step 1. We cannot use the annuity method, but we can enter, in the cash flow register, the following: $CF_0 = 44100$; $CF_1 = 46305$; $CF_2 = 48620$. Then enter $I = 8$; and press \blacksquare NPV to find $NPV = PV = \$128,659$.

Step 3: The \$100,000 now on hand will compound at 8% for 2 years: $\$100,000(1.08)^2 = \$116,640$.

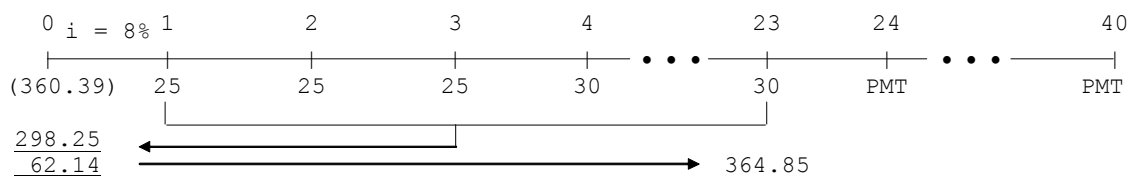
Step 4: The net funds needed is:

Need at $t = 2$	\$ 128,659
Will have	(116,640)
Net needed	<u>\$ 12,019</u>

Step 5: Find the payments needed to accumulate \$12,019. Set the calculator to Begin mode and then enter: $N = 2$; $I = 8$; $PV = 0$; $FV = 12019$; and then solve for $PMT = \$5,350$.

105. Required annuity payments

Answer: c Diff: T



Calculate the NPV of payments in Years 1-23:

$$CF_0 = 0; CF_{1-3} = 25; CF_{4-23} = 30; I = 8; \text{ and then solve for } NPV = \$298.25.$$

Difference between the security's price and PV of payments:

$$\$360.39 - \$298.25 = \$62.14.$$

Calculate the FV of the difference between the purchase price and PV of payments, Years 1-23:

$$N = 23; I = 8; PV = -62.14; PMT = 0; \text{ and then solve for } FV = \$364.85.$$

Calculate the value of the annuity payments in Years 24-40:

$$N = 17; I = 8; PV = -364.85; FV = 0; \text{ and then solve for } PMT = \$40.$$

106. Required annuity payments

Answer: a Diff: T

	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	12%													
Savings:	5,000													
Contrib.	3,000	3,000	3,000	3,000	3,000	PMT	PMT	PMT	PMT	PMT	PMT			
												College: 24,433	25,655	26,938 28,285
														PV college costs = 88,947

Step 1: Determine college costs:

College costs will be $\$15,000(1.05)^{10} = \$24,433$ at $t = 10$,
 $\$15,000(1.05)^{11} = \$25,655$ at $t = 11$, $\$15,000(1.05)^{12} = \$26,938$
at $t = 12$, and $\$15,000(1.05)^{13} = \$28,285$ at $t = 13$.

Step 2: Determine PV of college costs at $t = 10$:

Enter the cash flows into the cash flow register as follows:
 $CF_0 = 24433$; $CF_1 = 25655$; $CF_2 = 26938$; $CF_3 = 28285$; $I = 12$; and
then solve for $NPV = \$88,947$.

Step 3: Determine the value of their savings at $t = 4$ as follows:

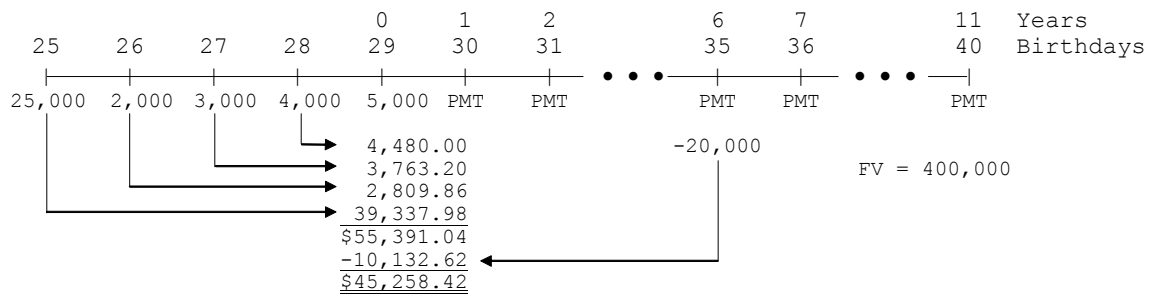
$N = 4$; $I = 12$; $PV = 8000$; $PMT = 3000$; and then solve for $FV =$
 $\$26,926$.

Step 4: Determine the value of the annual contributions from $t = 5$
through $t = 10$:

$N = 6$; $I = 12$; $PV = -26926$; $FV = 88947$; and then solve for PMT
 $= -\$4,411$.

107. Required annuity payments

Answer: a Diff: T



Step 1: Compound cash flows from birthdays 25, 26, 27, and 28 to 29th birthday:

$$\begin{aligned} & \$25,000(1.12)^4 + \$2,000(1.12)^3 + \$3,000(1.12)^2 + 4,000(1.12) + \\ & \$5,000(1.12)^0 \\ & = \$39,337.98 + \$2,809.86 + \$3,763.20 + \$4,480.00 + \$5,000.00 \\ & = \$55,391.04. \end{aligned}$$

Step 2: Discount \$20,000 withdrawal back to 29th birthday (6 years):

$$N = 6; I = 12; PMT = 0; FV = 20000; \text{ and then solve for } PV = \$10,132.62. \text{ (Remember to add minus sign as this is a withdrawal.)}$$

Step 3: Subtract the present value of the withdrawal from the compounded values of the deposits to obtain the net amount on hand at birthday 29 (after the \$20,000 withdrawal is considered):

$$\$55,391.04 - \$10,132.62 = \$45,258.42.$$

Step 4: Solve for the required annuity payment as follows:

$$N = 11; I = 12; PV = -45258.42; FV = 400000; \text{ and then solve for } PMT = \$11,743.95.$$

108. Required annuity payments**Answer: c Diff: T**

- Step 1: Convert the 9 percent monthly rate to an annual rate.
Enter $NOM\% = 9$; $P/YR = 12$; and then solve for $EFF\% = 9.3807\%$.
- Step 2: Compute the amount accumulated by age 40. Remember to change P/YR from 12 to 1. BEGIN mode. Then, enter $N = 15$; $I = 9.3807$; $PV = 0$; $PMT = 2000$; and then solve for $FV = \$66,184.35$.
- Step 3: John needs \$3 million in 25 years. Find the PV of this amount today. Remember to change your calculator back from BEGIN to END mode. Enter $N = 25$; $I = 12$; $FV = 3000000$; $PMT = 0$; and then solve for $PV = \$176,469.92$.
- Step 4: Find the shortfall today, the difference between the present value of what he needs in 25 years and the present value of what he's accumulated today. $\$176,469.92 - \$66,184.35 = \$110,285.57$.
- Step 5: Find the annuity needed to cover this shortfall. Since the contributions begin today this is an annuity due, so the calculator must be set up in BEGIN mode. (Remember to change your calculator back from BEGIN to END mode after working this problem.) BEGIN mode. Then, enter $N = 26$; $I = 12$; $PV = -110285.57$; $FV = 0$; and then solve for $PMT = \$12,471.31 \approx \$12,471$.

109. Required annuity payments**Answer: a Diff: T**

- Step 1: Calculate the cost of tuition in each year:
College cost today = \$15,000, Inflation = 5%.
 $\$15,000(1.05)^6 = \$20,101.43(1) = \$20,101.43$; $\$15,000(1.05)^7 = \$21,106.51(1) = \$21,106.51$; $\$15,000(1.05)^8 = \$22,161.83(2) = \$44,323.66$; $\$15,000(1.05)^9 = \$23,269.92(2) = \$46,539.85$; $\$15,000(1.05)^{10} = \$24,433.42(1) = \$24,433.42$; $\$15,000(1.05)^{11} = \$25,655.09(1) = \$25,655.09$.
- Step 2: Find the present value of college costs at $t = 0$:
 $CF_0 = 0$; $CF_{1-5} = 0$; $CF_6 = 20101.43$; $CF_7 = 21106.51$; $CF_8 = 44323.66$; $CF_9 = 46539.85$; $CF_{10} = 24433.42$; $CF_{11} = 25655.09$; $I = 12$; and then solve for $NPV = \$69,657.98$.
- Step 3: Find the PV of the \$25,000 gift received in Year 3:
 $N = 3$; $I = 12$; $PMT = 0$; $FV = 25000$; and then solve for $PV = -\$17,794.51$.
- Step 4: Calculate the PV of the net amount needed to fund college costs:
 $\$69,657.98 - \$17,794.51 = \$51,863.47$.
- Step 5: Calculate the annual contributions:
BEGIN, $N = 12$; $I = 12$; $PV = -51863.47$; $FV = 0$; and then solve for $PMT = \$7,475.60$.

110. Required annuity payments**Answer: b Diff: T**

First, what will be the present value of the college costs plus the \$50,000 nest egg as of September 1, 2017?

The first tuition payment, CF_0 , will equal $\$10,000 \times (1.06)^{15} = \$23,965.58$. Each tuition payment will increase by 6%, hence $CF_1 = \$25,403.52$; $CF_2 = \$26,927.73$; $CF_3 = \$28,543.39$; and $CF_4 = \$50,000$ (the nest egg); $I = 8$. The present value at September 1, 2017, at 8%, is \$129,983.70.

Now, what payments are needed every year until then?

$N = 15$; $I = 8$; $PV = 10000$; $FV = -129983.70$; and then solve for $PMT = \$3,618.95$.

111. Required annuity payments**Answer: a Diff: T**

Step 1 Calculate the cost of tuition in each year:

$\$25,000(1.05)^{15} = \$51,973.20$; $\$25,000(1.05)^{16} = \$54,571.86 \times 2 = \$109,143.73$; $\$25,000(1.05)^{17} = \$57,300.46 \times 2 = \$114,600.92$; $\$25,000(1.05)^{18} = \$60,165.48 \times 2 = \$120,330.96$; $\$25,000(1.05)^{19} = \$63,173.75$.

Step 2 Find the present value of these costs at $t = 15$:

$CF_0 = 51973.20$; $CF_1 = 109143.73$; $CF_2 = 114600.92$; $CF_3 = 120330.96$; $CF_4 = 63173.75$; $I = 12$; and then solve for NPV = \$366,579.37.

Step 3 Calculate the FV of Grandma's deposits at $t = 15$:

Older son: $\$10,000(1.12)^{18} = \$76,899.66$ (Deposit was made 3 years ago.)

Younger son: $\$10,000(1.12)^{17} = \$68,660.41$ (Deposit was made 2 years ago.)

Total = \$145,560.07

Step 4 Calculate net total amount needed at $t = 15$:

$\$366,579.37 - \$145,560.07 = \$221,019.30$.

Step 5 Calculate the annual required deposits:

$N = 15$; $I = 12$; $PV = 0$; $FV = 221019.30$; and then solve for $PMT = -\$5,928.67$.

112. Required annuity payments**Answer: a Diff: T**

Step 1: Calculate how much Donald will retire with:

Enter the following input data in the calculator:

$N = 40$; $I = 12$; $PV = -10000$; $PMT = -5000$ and then solve for $FV = \$4,765,966.81$. (Note that the beginning amount and annual contribution are entered as negative amounts since they are deposits made into the account.)

Step 2: Now, calculate what Jerry's annual contribution must be:

$N = 36$; $I = 12$; $PV = 0$; $FV = 4,765,966.81$; and then solve for $PMT = \$9,837.63 \approx \$9,838$. (Note that we didn't have to use the BEGIN mode because the cash flows can be assumed to come at the end of the year, if we assume that Jerry's birthday occurs at the end of the year.)

Alternative way:

Using the BEGIN mode we could arrive at the same required annuity payment in a different way, if we assume that the payments occur at the start of the year. But, we also have to move the FV ahead one year so that it in effect occurs at the end of the last year.

Enter the following input data in the calculator:

BEGIN, $N = 36$; $I = 12$; $PV = 0$; $FV = 4,765,966.81 \times 1.12 = 5,337,882.83$, and then solve for $PMT = \$9,837.63 \approx \$9,838$.

113. Required annuity payments**Answer: b Diff: T**

Step 1: Find out what the cost of college will be in six years:

Enter the following input data in the calculator:

$N = 6$; $I = 5$; $PV = -20000$; $PMT = 0$; and then solve for $FV = \$26,801.9128$.

Step 2: Calculate the present value of his college cost:

Enter the following input data in the calculator:

$N = 6$; $I = 10$; $PMT = 0$; $FV = 26,801.9128$; and then solve for $PV = \$15,128.98$.

Step 3: Find the present value today of the \$15,000 that will be withdrawn in two years for the purchase of a used car:

Enter the following input data in the calculator:

$N = 2$; $I = 10$; $PMT = 0$; $FV = 15000$; and then solve for $PV = \$12,396.69$.

So in total, in today's dollars, he needs $\$15,128.98 + \$12,396.69 = \$27,525.67$, and his shortfall in today's dollars is $\$25,000 - \$27,525.67 = \$2,525.67$.

Step 4: Find out how much Bob has to save at the end of each year to make up the \$2,525.67:

Enter the following input data in the calculator:

$N = 6$; $I = 10$; $PV = -2525.67$; $FV = 0$; and then solve for $PMT = \$579.9125 \approx \580 .

114. Required annuity payments**Answer: e Diff: T N**

We must find the PV of the amount we can sell the car for in 4 years. Enter the following data into your financial calculator:

$N = 48$; $I = 1$; $FV = 6000$; $PMT = 0$; and then solve for $PV = \$3,721.56$.

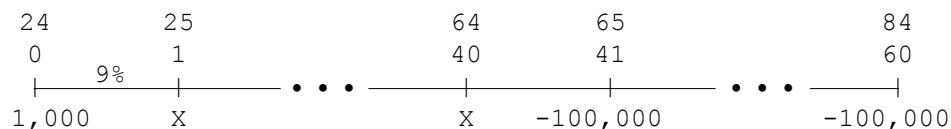
This means that the total cost of the car, in present value terms is:
 $\$17,000 - \$3,721.56 = \$13,278.44$.

Now, we need to find the lease payment that equates to this present value. Enter the following data into your financial calculator:

$N = 48$; $I = 1$; $PV = 13278.44$; $FV = 0$; and then solve for $PMT = \$349.67$.

115. Required annuity payments**Answer: c Diff: T N**

Here is the diagram of the problem:



Step 1: Determine the PV at his 64th birthday of the cash outflows from his 65th birthday to his 84th birthday. Using a financial calculator, enter the following input data:

$N = 20$; $I = 9$; $PMT = -100000$; $FV = 0$; and then solve for $PV = \$912,854.57$.

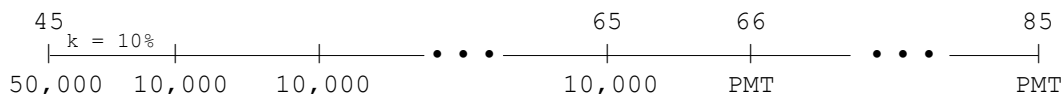
This is the amount he needs to have in his account on his 64th birthday in order to make 20 withdrawals of \$100,000 from his account.

Step 2: Determine the required annual payment (deposit) that will achieve this goal, given the \$1,000 original deposit. Using a financial calculator, enter the following input data:

$N = 40$; $I = 9$; $PV = -1000$; $FV = 912854.57$; and then solve for $PMT = \$2,608.73$.

116. Required annuity payments

Answer: a Diff: T N



Step 1: Calculate the value of his deposits and the initial balance of his brokerage account at age 65:

$N = 20$; $I = 10$; $PV = 50000$; $PMT = 10000$; and then solve for $FV = \$909,124.9924$.

Step 2: Determine the amount of his 20-year annuity (withdrawals) based on the value of his brokerage account determined above:

$N = 20$; $I = 10$; $PV = 909124.9924$; $FV = 0$; and then solve for $PMT = \$106,785.48$.

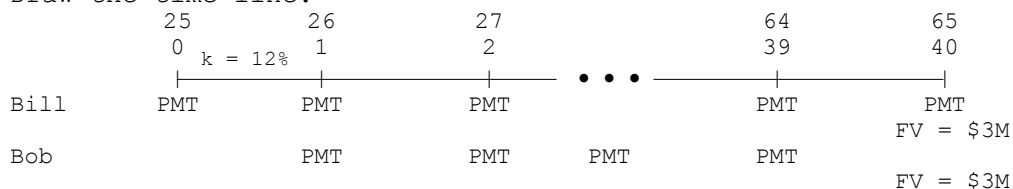
Thus, he can withdraw \$106,785.48 from the account starting on his 66th birthday, and do so for the next 20 years, leaving a final account balance of zero on his last withdrawal on his 85th birthday.

117. Annuity due vs. ordinary annuity

Answer: e Diff: T

There is more than one way to solve this problem.

Step 1: Draw the time line:



Step 2: Determine each's annual contribution:

Bill: He starts investing today, so use the BEG mode of the calculator.

Enter the following input data in the calculator:

$N = 41$; $I = 12$; $PV = 0$; $FV = 3,000,000 \times 1.12 = 3360000$; and then solve for $PMT = \$3,487.79$. (The FV is calculated as \$3,360,000 because the annuity will calculate the value to the end of the year, until Bill is a second away from age 66. Therefore, since he wants to have \$3,000,000 by age 65, he would have $\$3,000,000 \times 1.12$ one second before he turns 66.)

Bob: He starts investing at the end of this year, so use the END mode of the calculator.

Enter the following input data in the calculator:

$N = 40$; $I = 12$; $PV = 0$; $FV = 3000000$; and then solve for $PMT = \$3,910.88$.

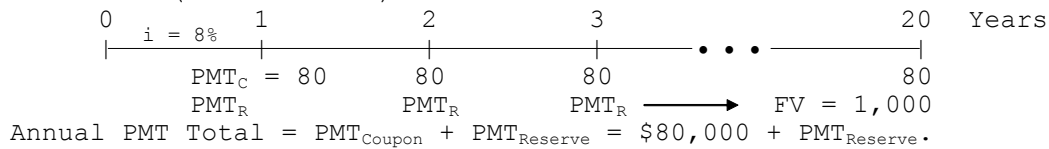
Step 3: Determine the difference between the two payments:

The difference is $\$3,910.88 - \$3,487.79 = \$423.09$.

118. Amortization

Answer: b Diff: T

Time Line (in thousands):



Financial calculator solution:

Long way Inputs: $N = 20$; $I = 8$; $PV = 0$; $FV = 1000000$.

Output: $PMT = -\$21,852.21$.

Add coupon interest and reserve payment together

Annual $PMT_{\text{Total}} = \$80,000 + \$21,852.21 = \$101,852.21$.

Total number of tickets = $\$101,852.21 / \$10.00 = 10,185.22 \approx 10,186$.*

Short way Inputs: $N = 20$; $I = 8$; $PV = 1000000$; $FV = 0$.

Output: $PMT = -\$101,852.21$.

Total number of tickets = $\$101,852.21 / \$10.00 \approx 10,186$.*

*Rounded up to next whole ticket.

119. FV of an annuity

Answer: c Diff: T

Step 1: The value of what they have saved so far is:

Enter the following input data in the calculator:

$N = 25$; $I = 12$; $PV = -20000$; $PMT = -5000$; and then solve for $FV = \$1,006,670.638$.

Step 2: Deduct the amount to be paid out in 3 years:

Enter the following input data in the calculator:

$N = 3$; $I = 12$; $PMT = 0$; $FV = 150000$; and then solve for $PV = \$106,767.037$.

The value remaining is $\$1,006,670.638 - \$106,767.037 = \$899,903.601$.

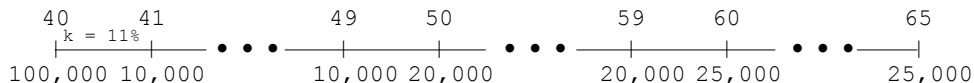
Step 3: Determine how much will be in the account on their 58th birthday, after 8 more annual contributions:

Enter the following input data in the calculator:

$N = 8$; $I = 12$; $PV = -899903.601$; $PMT = -5000$; and then solve for $FV = \$2,289,626.64 \approx \$2,289,627$.

120. FV of an annuity**Answer: e Diff: T**

Step 1: The first step is to draw the time line. This is critical. Next, break the story up into three parts--the 40's, the 50's, and the 60's.



Put your calculator in END mode, set P/YR = 1.

Step 2: Calculate the FV of her 40's contributions on her 49th birthday:

N = 9; I/YR = 11; PV = -100000; PMT = -10000; and then solve for FV₄₉ = \$397,443.41.

Now, this is the PV of her contributions on her 49th birthday.

Step 3: Determine the FV of her contributions through her 59th birthday:

N = 10; I/YR = 11; PV₄₉ = -397443.41; PMT = -20000; and then solve for FV₅₉ = \$1,462,949.35.

Now, this is the PV of her contributions so far on her 59th birthday.

Step 4: Determine the FV of all her contributions:

N = 6; I = 11; PV₅₉ = -1462949.35; PMT = -25,000; and then solve for FV₆₅ = \$2,934,143.24 ≈ \$2,934,143.

121. EAR and FV of annuity**Answer: c Diff: T N**

First, we must find the appropriate effective rate of interest. Using your calculator enter the following data as inputs as follows:

NOM% = 6; P/YR = 12; and then solve for EFF% = 6.167781%.

Since the contributions are being made every 6 months, we need to determine the nominal annual rate based on semiannual compounding. Enter the following data in your calculator as follows:

EFF% = 6.167781%; P/YR = 2; and then solve for NOM% = 6.0755%.

Now use the periodic rate 6.0755%/2 = 3.037751% to calculate the FV of the annuities due. Now, we must solve for the value of all contributions as of the end of Year 2. Enter the following data inputs in your calculator:

N = 4; I = 3.037751; PV = 1000; PMT = 1000; and then solve for FV = \$5,313.14.

So, these contributions will be worth \$5,313.14 as of the end of Year 2. Now, we must find the value of this investment after the eighth year. For this calculation, we can use annual periods and the effective annual rate calculated earlier. Enter the following data as inputs to your calculator: N = 6; I = 6.167781; PV = -5313.14; PMT = 0; and then solve for FV = \$7,608.65 ≈ \$7,609.

122. FV of annuity due**Answer: a Diff: T**

First, convert the 9 percent return with quarterly compounding to an effective rate of 9.308332%. With a financial calculator, $NOM\% = 9$; $P/YR = 4$; $EFF\% = 9.308332\%$. (Don't forget to change $P/YR = 4$ back to $P/YR = 1$.) Then calculate the FV of all but the final payment. BEGIN MODE (1 P/YR) $N = 9$; $I/YR = 9.308332$; $PV = 0$; $PMT = 1500$; and solve for $FV = \$21,627.49$. You must then add the \$1,500 at $t = 9$ to find the answer, \$23,127.49.

123. FV of investment account**Answer: b Diff: T**

We need to figure out how much money they would have saved if they didn't pay for the college costs.

$N = 40$; $I = 10$; $PV = 0$; $PMT = -12000$; and then solve for $FV = \$5,311,110.67$.

Now figure out how much they would use for college costs. First get the college costs at one point in time, $t = 20$, using the cash flow register. $CF_0 = 58045$; $CF_1 = 62108$; $CF_2 = 66,456 \times 2 = 132912$ (two kids in school); $CF_3 = 71,108 \times 2 = 142216$; $CF_4 = 76086$; $CF_5 = 81411$; $I = 10$; $NPV = \$433,718.02$.

The value of the college costs at year $t = 20$ is \$433,718.02. What we want is to know how much this is at $t = 40$.

$N = 20$; $I = 10$; $PV = -433718.02$; $PMT = 0$; and then solve for $FV = \$2,917,837.96$.

The amount in the nest egg at $t = 40$ is the amount saved less the amount spent on college.

$\$5,311,110.67 - \$2,917,837.96 = \$2,393,272.71 \approx \$2,393,273$.

124. Effective annual rate**Answer: c Diff: T**

Time Line:



Numerical solution:

Step 1: Find the effective annual rate (EAR) of interest on the bank deposit

$$\text{EAR}_{\text{Daily}} = (1 + 0.080944/365)^{365} - 1 = 8.43\%.$$

Step 2: Find the EAR of the investment

$$\$8,000 = \$10,000 / (1 + i)^{2.25}$$

$$(1 + i)^{2.25} = 1.25$$

$$1 + i = 1.25^{(1/2.25)}$$

$$1 + i = 1.10426$$

$$i = 0.10426 \approx 10.43\%$$

Step 3: Difference = 10.43% - 8.43% = 2.0%.

Financial calculator solution:

Calculate $\text{EAR}_{\text{Daily}}$ using interest rate conversion feature

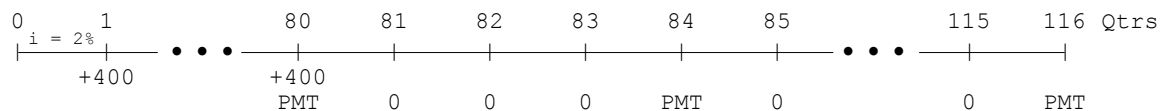
Inputs: P/YR = 365; NOM% = 8.0944. Output: EFF% = EAR = 8.43%.

Calculate EAR of the equal risk investment

Inputs: N = 2.25; PV = -8000; PMT = 0; FV = 10000.

Output: I = 10.4259 \approx 10.43%.

Difference: 10.43% - 8.43% = 2.0%.

125. PMT and quarterly compounding**Answer: b Diff: T**

Find the FV at $t = 80$ of \$400 quarterly payments:

N = 80; I = 2; PV = 0; PMT = 400; and then solve for FV = \$77,508.78.

Find the EAR of 8%, compounded quarterly, so you can determine the value of each of the receipts:

$$\text{EAR} = \left(1 + \frac{0.08}{4}\right)^4 - 1 = 8.2432\%.$$

Now, determine the value of each of the receipts, remembering that this is an annuity due.

Put the calculator in BEG mode and enter the following input data in the calculator:

N = 10; I = 8.2432; PV = -77508.78; FV = 0; and then solve for PMT = \$10,788.78 \approx \$10,789.

126. Non-annual compounding

Answer: a Diff: T

To compare these alternatives, find the present value of each strategy and select the option with the highest present value.

Option 1 can be valued as an annuity due.

Enter the following input data in the calculator:

BEGIN mode (to indicate payments will be received at the start of the period) $N = 12$; $I = 12/12 = 1$; $PMT = -1000$; $FV = 0$; and then solve for $PV = \$11,367.63$.

Option 2 can be valued as a lump sum payment to be received in the future.

Enter the following input data in the calculator:

END mode (to indicate the lump sum will be received at the end of the year) $N = 2$; $I = 12/2 = 6$; $PMT = 0$; $FV = -12750$; and then solve for $PV = \$11,347.45$.

Option 3 can be valued as a series of uneven cash flows. The cash flows at the end of each period are calculated as follows:

$CF_0 = \$0.00$; $CF_1 = \$800.00$; $CF_2 = \$800.00(1.20) = \960.00 ; $CF_3 = \$960.00(1.20) = \$1,152.00$; $CF_4 = \$1,152.00(1.20) = \$1,382.40$; $CF_5 = \$1,382.40(1.20) = \$1,658.88$; $CF_6 = \$1,658.88(1.20) = \$1,990.66$; $CF_7 = \$1,990.66(1.20) = \$2,388.79$; $CF_8 = \$2,388.79(1.20) = \$2,866.54$.

To find the present value of this cash flow stream using your financial calculator enter:

END mode (to indicate the cash flows will occur at the end of each period) 0 CF_j ; 800 CF_j ; 960 CF_j ; 1152 CF_j ; 1382.40 CF_j ; 1658.88 CF_j ; 1990.66 CF_j ; 2388.79 CF_j ; 2866.54 CF_j (to enter the cash flows); $I/YR = 12/4 = 3$; solve for $NPV = \$11,267.37$.

Choose the alternative with the highest present value, and hence select Choice 1 (Answer a).

127. Value of unknown withdrawal**Answer: d Diff: T**

- Step 1: Find out how much Steve and Robert have in their accounts today:
You can get this from analyzing Steve's account.
End mode: $N = 9$; $I = 6$; $PV = -5000$; $PMT = -5000$; and then solve for $FV = \$65,903.9747$.
Alternatively, Begin mode: $N = 9$; $I = 6$; $PV = 0$; $PMT = -5000$; and then solve for $FV = \$60,903.9747$.
Then add the \$5,000 for the last payment to get a total of \$65,903.9747.
This is also the value of Robert's account today.
- Step 2: Find out how much Robert would have had if he had never withdrawn anything:
End mode: $N = 9$; $I = 12$; $PV = -5000$; $PMT = -5000$; and then solve for $FV = \$87,743.6753$.
Alternatively, Begin mode: $N = 9$; $I = 12$; $PV = 0$; $PMT = -5000$; and then solve for $FV = \$82,743.6753$.
Then add the \$5,000 for the last payment to get a total of \$87,743.6753.
- Step 3: Find the difference in the value of Robert's account due to the withdrawal made:
However, since he took money out at age 27, he has only \$65,903.9747. The difference between what he has and what he would have had is:
 $\$87,743.6753 - \$65,903.9747 = \$21,839.7006$.
- Step 4: Determine the amount of Robert's withdrawal by compounding the value found in Step 3:
 $N = 3$; $I = 12$; $PMT = 0$; $FV = -21839.7006$; then solve for $PV = \$15,545.0675 \approx \$15,545.07$.

128. Breakeven annuity payment**Answer: a Diff: T N**

- Step 1: Calculate the NPV of purchasing the car by entering the following data in your financial calculator:
 $CF_0 = -17000$; $CF_{1-47} = 0$; $CF_{48} = 7000$; $I = 6/12 = 0.5$; and then solve for $NPV = -\$11,490.31$.
- Step 2: Now, use the NPV calculated in Step 1 to determine the breakeven lease payment that will cause the two NPVs to be equal. Enter the following data in your financial calculator:
 $N = 48$; $I = 0.5$; $PV = -11490.31$; $FV = 0$; and then solve for $PMT = \$269.85$.

129. Required mortgage payment**Answer: b Diff: E N**

- Just enter the following data into your calculator and solve for the monthly mortgage payment.
- $N = 360$; $I = 7/12 = 0.583333$; $PV = -115000$; $FV = 0$; and then solve for $PMT = \$765.0979 \approx \765.10 .

130. Remaining mortgage balance**Answer: e Diff: E N**

With the data still input into your calculator, using an HP-10B press
1 INPUT 60 ■ AMORT
= displays Interest: \$39,157.2003
= displays Principal: \$6,748.6737
= displays Balance: \$108,251.3263

131. Time to accumulate a lump sum**Answer: d Diff: E N**

You must solve this time value of money problem for N (number of years) by entering the following data in your calculator:
I = 10; PV = -2000; PMT = -1000; FV = 1000000; and then solve for N = 46.51.

Because there is a fraction of a year and the problem asks for whole years, we must round up to the next year. Hence, the answer is 47 years.

132. Required annual rate of return**Answer: c Diff: E N**

Now, the time value of money problem has been modified to solve for I. Enter the following data in your calculator:
N = 39; PV = -2000; PMT = -1000; FV = 1000000; and then solve for I = 12.57%.

133. Monthly mortgage payments**Answer: c Diff: E N**

Enter the following data as inputs in your calculator:
N = 30 × 12 = 360; I = 7.2/12 = 0.60; PV = -100000; FV = 0; and then solve for PMT = \$678.79.

134. Amortization**Answer: d Diff: M N**

Use your calculator, after entering the data to determine the mortgage payment, as follows:

1 INPUT 36 ■ AMORT
= Interest: \$21,280.8867
= Principal: \$3,155.4885
= Balance: \$96,844.5115.

So, the percentage that goes to principal = $\frac{\$3,155.49}{36 \times \$678.79} = \frac{\$3,155.49}{\$24,436.44} = 12.91\%$.

135. Monthly mortgage payments**Answer: d Diff: E N**

Using your financial calculator, enter the following data inputs:
N = 180; I = 7.75/12 = 0.645833; PV = -165000; FV = 0; and then solve for PMT = \$1,553.104993 ≈ \$1,553.10.

136. Remaining mortgage balance**Answer: c Diff: E N**

The complete solution looks like this:

Beginning of Period	Mortgage Balance	Payment	Interest	Ending Mortgage Balance
1	\$165,000.00	\$1,553.10	\$1,065.63	\$164,512.52
2	164,512.52	1,553.10	1,062.48	164,021.89
3	164,021.89	1,553.10	1,059.31	163,528.09
4	163,528.09	1,553.10	1,056.12	163,031.11
5	163,031.11	1,553.10	1,052.91	162,530.91
6	162,530.91	1,553.10	1,049.68	162,027.49
7	162,027.49	1,553.10	1,046.43	161,520.81
8	161,520.81	1,553.10	1,043.16	161,010.86
9	161,010.86	1,553.10	1,039.86	160,497.62
10	160,497.62	1,553.10	1,036.55	159,981.06
11	159,981.06	1,553.10	1,033.21	159,461.16
12	159,461.16	1,553.10	1,029.85	158,937.91

Alternatively, using your financial calculator, do the following (with the data still entered from the previous problem):

```
1 INPUT 12 ■ AMORT
= Interest: $12,575.172755
= Principal: $6,062.087161
= Balance: $158,937.912839
```

137. Amortization**Answer: d Diff: M N**

Step 1: Find the monthly payment:

$N = 360$; $I = 8/12 = 0.6667$; $PV = 75000$; $FV = 0$; and then solve for $PMT = \$550.3234$.

Step 2: Calculate value of monthly payments for the first year:

Total payments for the first year are $\$550.3234 \times 12 = \$6,603.8812$.

Step 3: Use calculator to determine amount of interest during first year:

```
1 INPUT 12 ■ AMORT
= Interest: $5,977.3581
= Principal: $626.5227
= Balance: $74,373.4773
```

Step 4: Calculate percentage of monthly payments that goes towards interest:

$\$5,977.3581 / \$6,603.8812 = 0.9051$, or 90.51%.

138. Amortization**Answer: a Diff: E N**

Step 1: Calculate old monthly payment:

$N = 360$; $I = 8/12 = 0.6667$; $PV = 75000$; $FV = 0$; and then solve for $PMT = \$550.3234$.

Step 2: Calculate new monthly payment:

$N = 360$; $I = 7/12 = 0.5833$; $PV = 75000$; $FV = 0$; and then solve for $PMT = \$498.9769$.

Step 3: Calculate the difference between the 2 mortgage payments:

This represents a savings of $(\$550.3234 - \$498.9769) = \$51.3465 \approx \51.35 .

139. Monthly mortgage payment**Answer: c Diff: E N**

Enter the following data in your calculator:

$N = 360$; $I = 7.2/12 = 0.60$; $PV = 300000$; $FV = 0$; and then solve for $PMT = \$2,036.3646 \approx \$2,036.36$.

140. Amortization**Answer: b Diff: M N**

Using the 10-B calculator, and using the above information:

1 INPUT 12 ■ AMORT
= Interest: \$21,504.5022
= Principal: \$2,931.8730
= Balance: \$297,068.1270

The percent paid toward principal = $\$2,931.87 / (\$2,931.87 + \$21,504.50) = 12\%$.

141. Monthly loan payments**Answer: a Diff: E N**

Enter the following data as inputs in your financial calculator:

$N = 48$; $I = 12/12 = 1$; $PV = -15000$; $FV = 0$; and then solve for $PMT = \$395.01$.

142. Amortization**Answer: e Diff: M N**

Use the calculator's amortization functions and the PMT information from the previous question. Enter the following data as inputs:

1 INPUT 24 ■ AMORT
= Interest: \$2,871.49
= Principal: \$6,608.75
= Balance: \$8,391.25

Total Payments = $24 \times \$395.01 = \$9,480.24$.

Percentage of payments that goes towards repayment of principal:

$\$6,608.75 / \$9,480.24 = 0.6971$, or 69.71%.

143. Effective annual rate**Answer: e Diff: E N**

Enter the following data as inputs in your financial calculator:

$P/Yr = 12$; $Nom\% = 12$, and then solve for $EFF\% = 12.6825\% \approx 12.68\%$.

WEB APPENDIX 6B SOLUTIONS

6B-1. PV continuous compounding **Answer: b Diff: E**

$$PV = FV_n / e^{in} = \$100,000 / e^{0.09(6)} = \$100,000 / 1.7160 = \$58,275.$$

6B-2. FV continuous compounding **Answer: a Diff: M**

Daily compounding:

$$FV_2 = PV (1 + 0.06/365)^{365(2)} = \$1,000 (1.12749) = \$1,127.49$$

Continuous compounding:

$$FV_2 = PVe^{in} = \$1,000 (e^{0.059(2)}) = \$1,000 (1.12524) = \underline{\$1,125.24}$$

$$\text{Difference between accounts} = \underline{\$2.25}$$

6B-3. Continuous compounded interest rate **Answer: a Diff: M**

Calculate the growth factor using PV and FV which are given:

$$FV_n = PV e^{in}; \$19,000 = \$14,014 e^{i4}$$

$$e^{i4} = 1.35579.$$

Take the natural logarithm of both sides:

$$i(4) \ln e = \ln 1.35579.$$

The natural log of $e = 1.0$.

Inputs: 1.35579. Press LN key. Output: LN = 0.30438.

$$i(4) \ln e = \ln 1.35579$$

$$i(4) = 0.30438$$

$$i = 0.0761 = 7.61\%.$$

6B-4. Payment and continuous compounding **Answer: d Diff: M**

0	$I_c = e^{0.07}$	1	2	3	Years
	$I_s = 4\%$	2	4	6	6-months
					Periods

Account with
continuous

compounding -1,000

$$FV_c = ? = 1,233.70$$

Account with
semiannual

compounding $PV_s = ?$

$$FV_s = ? = 1,233.70$$

Step 1: Calculate the FV of the \$1,000 deposit at 7% with continuous compounding:

Using e^x key:

Inputs: $X = 0.21$; press e^x key. Output: $e^x = 1.2337$.

$$FV_n = \$1,000 e^{0.07(3)} = \$1,000 (1.2337) = \$1,233.70.$$

Step 2: Calculate the PV or initial deposit:

Inputs: $N = 6$; $I = 4$; $PMT = 0$; $FV = 1233.70$.

Output: $PV = -\$975.01$.

6B-5. Continuous compounding**Answer: a Diff: M**

Determine the effective annual rates.

$$(a) \quad 12.5\% \text{ annually} = 12.5\%.$$

$$(b) \quad 12.0\% \text{ semiannually} = \left(1 + \frac{0.12}{2}\right)^2 - 1.0 = 0.1236 = 12.36\%.$$

$$(c) \quad 11.5\% \text{ continuously} = e^{0.115} - 1.0 = 0.1219 = 12.19\%.$$

6B-6. Continuous compounding**Answer: b Diff: M**

Time line:



Numerical solution:

(Constant $e = 2.7183$ rounded.)

$$\$5,438 = PVe^{0.10(10)}$$

$$\$5,438 = PVe^1$$

$$PV = \$5,438/e$$

$$= \$5,438/2.7183 = \$2,000.52 \approx \$2,000.$$

Financial calculator solution:

Use e^x exponential key on calculator. Calculate EAR with continuous compounding.Inputs: $X = 0.10$; press e^x key.Output: $e^x = 1.1052$. $EAR = 1.1052 - 1.0 = 0.1052 = 10.52\%$.

Calculate PV of FV discounted continuously

Inputs: $N = 10$; $I = 10.52$; $PMT = 0$; $FV = 5438$.Output: $PV = -\$2,000$.**6B-7. Continuous compounding****Answer: d Diff: M**

Numerical solution:

$$e^{(0.04)(10)} = \left(1 + \frac{i}{2}\right)^{20}$$

$$e^{0.4} = \left(1 + \frac{i}{2}\right)^{20}$$

$$e^{0.02} = 1 + \frac{i}{2}$$

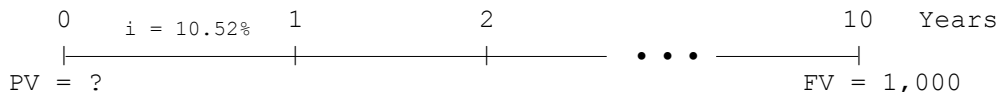
$$1.0202 = 1 + \frac{i}{2}$$

$$\frac{i}{2} = 0.0202$$

$$i = 0.0404 = 4.04\%.$$

6B-8. Continuous compounding**Answer: b Diff: M**

Time Line:



Numerical solution:

$$\$1,000 = PVe^{0.10(10)} = PVe^{1.0}$$

$$PV = \$1,000/e = \$1,000/2.7183 = \$367.88 \approx \$368.$$

Financial calculator solution:

Use e^x exponential key on calculator. Calculate EAR with continuous compounding.

Inputs: $X = 0.10$; press e^x key. Output: $e^x = 1.1052$.

EAR = $1.1052 - 1.0 = 0.1052 = 10.52\%$.

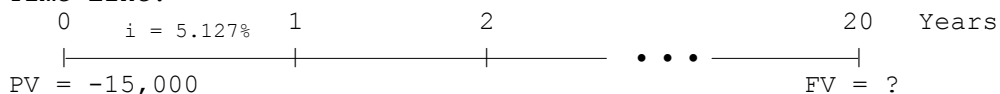
Calculate PV of FV discounting at the EAR:

Inputs: $N = 10$; $I = 10.52$; $PMT = 0$; $FV = 1000$.

Output: $PV = -\$367.78 \approx \368 .

6B-9. Continuous compounding**Answer: b Diff: M**

Time Line:



Numerical solution:

$$FV_{20} = \$15,000e^{0.05(20)} = \$40,774.23 \approx \$40,774.$$

Financial calculator solution:

(Note: We carry the EAR to 5 decimal places for greater precision in order to come closer to the correct exponential solution.)

Inputs: $X = 0.05$; press e^x key. Output: $e^x = 1.05127$.

EAR = $1.05127 - 1.0 = 0.05127 = 5.127\%$.

Calculate FV compounded continuously at EAR = 5.127%

Inputs: $N = 20$; $I = 5.127$; $PV = -15000$; $PMT = 0$.

Output: $FV = \$40,773.38 \approx \$40,774$.