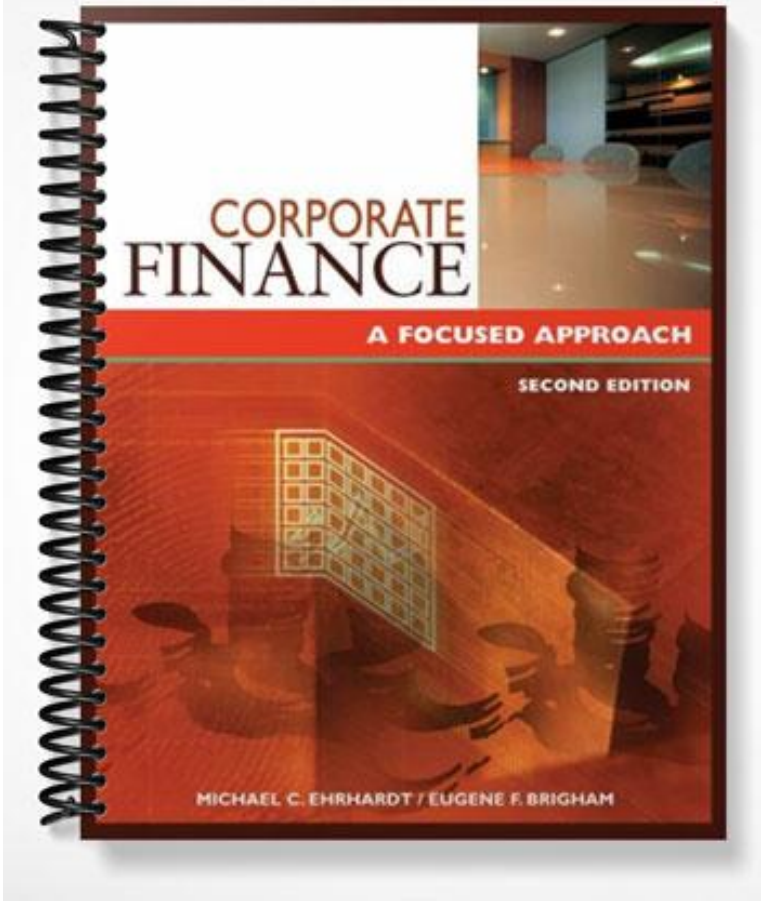
TEST BANK


CORPORATE
FINANCE
A FOCUSED APPROACH
SECOND EDITION
MICHAEL C. EHRHARDT / EUGENE F. BRIGHAM

CHAPTER 2
TIME VALUE OF MONEY

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

Note: Most problems assume students have a calculator with a y^x feature (i.e., an exponential feature). Annuity problems for finding the interest rate or the number of periods are in the financial calculator section at the end of this chapter.

True-False

Easy:

PV versus FV **Answer: b Diff: E**

1. If the discount (or interest) rate is positive, the present value of an expected series of payments will always exceed the future value of the same series.

   a. True
   b. False

PV versus FV **Answer: a Diff: E**

2. Disregarding risk, if money has time value, it is impossible for the present value of a given sum to be greater than its future value.

   a. True
   b. False

Amortization **Answer: a Diff: E**

3. The payment made each period on an amortized loan is constant, and it consists of some interest and some principal. The later we are in the loan's life, the larger the principal portion of the payment.

   a. True
   b. False

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

4. If a bank uses quarterly compounding for savings accounts, the nominal rate will be greater than the effective annual rate.

   a. True
   b. False

Retirement and compounding **Answer: a Diff: E**

5. One of the potential benefits of investing early for retirement is that an investor can receive greater benefits from the compounding of interest.

   a. True
   b. False

Medium:

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

6. All other factors held constant, the present value of a given annual annuity decreases as the number of discounting periods per year increases.

   a. True
   b. False

PV of a sum **Answer: a Diff: M**

7. The present value of a future sum decreases as either the discount rate or the number of discount periods per year increases.

   a. True
   b. False

Compounding **Answer: b Diff: M**

8. The greater the number of compounding periods within a year, the greater the future value of a lump sum invested initially, and the greater the present value of a given lump sum to be received at maturity.

   a. True
   b. False

Comparative compounding **Answer: a Diff: M**

9. Suppose an investor can earn a steady 5 percent annually with investment A, while investment B will yield a constant 12 percent annually. Within 11 years' time, the compounded value of investment B will be more than twice the compounded value of investment A (ignore risk).

   a. True
   b. False

Amortization **Answer: b Diff: M**

10. When a loan is amortized, the largest portion of the periodic payment goes to reduce principal in the early years of the loan such that the accumulated interest can be spread out over the life of the loan.

    a. True
    b. False

Effective and nominal rates **Answer: b Diff: M**

11. The effective annual rate is always greater than the nominal rate as a result of compounding effects.

    a. True
    b. False

Periodic and nominal rates **Answer: a Diff: M**

12. If we calculate a periodic interest rate, say a monthly rate, in order to get the nominal annual rate, we can multiply the periodic rate by the number of periods within a year.

    a. True
    b. False

Lump sum and annuity **Answer: b Diff: M**

13. Since we usually assume positive interest rates in time value analyses, the present value of a three-year annuity will always be less than the future value of a single lump sum, if the annuity payment equals the original lump sum investment.

    a. True
    b. False

Multiple Choice: Conceptual

Easy:

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

14. 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. Answers b and c above.
    e. Answers a and b above.

PV versus FV **Answer: e Diff: E**

15. Which of the following statements is most correct?

    a. If the discount (or interest) rate is positive, the future value of an expected series of payments will always exceed the present value of the same series.
    b. To increase present consumption beyond present income normally requires either the payment of interest or else an opportunity cost of interest foregone.
    c. Disregarding risk, if money has time value, it is impossible for the present value of a given sum to be greater than its future value.
    d. Disregarding risk, if the present value of a sum is equal to its future value, either r = 0 or t = 0.
    e. Each of the statements above is true.

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

16. 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**

17. 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. Both statements b and c are correct.
    e. All of the statements above are correct.

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

18. 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.

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

19. Which of the following statements is most correct?

    a. If annual compounding is used, the effective annual rate equals the nominal rate.
    b. If annual compounding is used, the effective annual rate equals the periodic rate.
    c. If a loan has a 12 percent nominal rate with semiannual compounding, its effective annual rate is equal to 11.66 percent.
    d. Answers a and b are correct.
    e. Answers a and c are correct.

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

20. Which of the following bank accounts has the highest effective annual return?

    a. An account which pays 10 percent nominal interest with monthly compounding.
    b. An account which pays 10 percent nominal interest with daily compounding.
    c. An account which pays 10 percent nominal interest with annual compounding.
    d. An account which 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**

21. 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**

22. 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 ten 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**

23. 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 which 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.

Medium:

Annuities **Answer: c Diff: M**

24. 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. Answers a and d are correct.

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

25. 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**

26. 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. Answers a and c are correct.
    e. All of the answers above are correct.

Time value concepts **Answer: c Diff: M**

27. Which of the following statements is most correct?

    a. An investment which 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 three-year $100 annuity due is less than the present value of a three-year $100 ordinary annuity.
    c. The proportion of the payment of a fully amortized loan which goes toward interest declines over time.
    d. Statements a and c are correct.
    e. None of the answers above is correct.

Tough:

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

28. 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 a, b, and c are all true.
e. Statements b and c are true.

Multiple Choice: Problems

Easy:

FV of a single payment **Answer: d Diff: E**

29. You deposit $2,000 in a savings account that pays 10 percent interest, compounded annually. How much will your account be worth in 15 years?

a. $2,030.21
b. $5,000.00
c. $8,091.12
d. $8,354.50
e. $9,020.10

FV of a single payment **Answer: c Diff: E**

30. You deposit $1,000 in a savings account that pays 9 percent interest, compounded annually. How much will your account be worth in 6 years?

a. $1,054.00
b. $1,199.00
c. $1,677.10
d. $1,689.48
e. $7,523.33

PV of a single payment **Answer: b Diff: E**

31. You can earn 8 percent interest, compounded annually. How much must you deposit today to withdraw $10,000 in 6 years?

a. $5,402.69
b. $6,301.70
c. $6,756.76
d. $8,432.10
e. $9,259.26

PV of a single payment **Answer: e Diff: E**

32. You can earn 15 percent interest, compounded annually. How much must you deposit today to withdraw $4,000 in 10 years?

a. $525.11
b. $842.51
c. $869.57
d. $957.57
e. $988.74

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

33. 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%

Solving for the interest rate for a single payment **Answer: e Diff: E**

34. Suppose you invested $1,000 in stocks 10 years ago. If your account is now worth $2,839.42, what rate of return did your stocks earn?

a. 15%
b. 14%
c. 13%
d. 12%
e. 11%

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

35. You are currently investing your money in a bank account which has a nominal annual rate of 7.23 percent, compounded annually. How many years will it take for you to double your money?

a. 8.67 years
b. 9.15 years
c. 9.50 years
d. 9.93 years
e. 10.25 years

Solving for N for a single payment **Answer: b Diff: E**

36. You are currently investing your money in a bank account which has a nominal annual rate of 8 percent, compounded annually. If you invest $2,000 today, how many years will it take for your account to grow to $10,000?

a. 22.91 years
b. 20.91 years
c. 18.91 years
d. 16.91 years
e. 14.91 years

FV of a sum **Answer: b Diff: E**

37. 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**

38. 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

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

39. 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**

40. You have the opportunity to buy a perpetuity which 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: c Diff: E**

41. 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**

42. 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**

43. 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

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

44. 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

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

45. Gomez Electronics needs to arrange financing for its expansion program. Bank A offers to lend Gomez the required funds on a loan where 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**

46. 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 return **Answer: b Diff: E**

47. Which of the following investments has the highest effective return (EAR)? (Assume that all CDs are of equal risk.)

    a. A bank CD which pays 10 percent interest quarterly.
    b. A bank CD which pays 10 percent monthly.
    c. A bank CD which pays 10.2 percent annually.
    d. A bank CD which pays 10 percent semiannually.
    e. A bank CD which pays 9.6 percent daily (on a 365-day basis).

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

48. Which one of the following investments provides the highest effective return?

    a. An investment which has a 9.9 percent nominal rate and quarterly annual compounding.
    b. An investment which has a 9.7 percent nominal rate and daily (365) compounding.
    c. An investment which has a 10.2 percent nominal rate and annual com-pounding.
    d. An investment which has a 10 percent nominal rate and semiannual com-pounding.
    e. An investment which has a 9.6 percent nominal rate and monthly com-pounding.

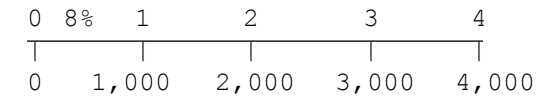
Effective annual return **Answer: b Diff: E**

49. Which of the following investments would provide an investor the *highest* effective annual return?

a. An investment which has a 9 percent nominal rate with semiannual com-pounding.
b. An investment which has a 9 percent nominal rate with quarterly com-pounding.
c. An investment which has a 9.2 percent nominal rate with annual com-pounding.
d. An investment which has an 8.9 percent nominal rate with monthly com-pounding.
e. An investment which has an 8.9 percent nominal rate with quarterly compounding.

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

50. You are given the following cash flows. What is the present value (t = 0) if the discount rate is 8 percent, rounded to a whole dollar?



a. $2,500
b. $4,804
c. $5,302
d. $7,963
e. $10,000

Interest payment on an amortized loan **Answer: b Diff: E**

51. You borrow $100,000. You make annual payments (at the end of the year)for 5 years. The interest rate is 10%. How much interest do you pay in year 2?

a. $7,362
b. $8,362
c. $10,000
d. $16,380
e. $26,380

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

52. Suppose you pay 15% as a nominal annual rate on your credit card. If you make monthly payments with monthly compounding, what is your effective annual rate?

a. 1.25%
b. 15.00%
c. 16.08%
d. 18.80%
e. 19.24%

Medium:

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

53. Assume you are to receive a 20-year annuity with annual payments of $50. The first payment will be received at the end of Year 1, and the last payment will be received at the end of Year 20. You will invest each payment in an account that pays 10 percent. What will be the value in your account at the end of Year 30?

    a. $6,354.81
    b. $7,427.83
    c. $7,922.33
    d. $8,591.00
    e. $6,752.46

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

54. Your uncle has agreed to deposit $3,000 in your brokerage account at the beginning of each of the next five years (t = 0, t = 1, t = 2, t = 3 and t = 4). You estimate that you can earn 9 percent a year on your investments. How much will you have in your account four years from now (at t = 4)? (Assume that no money is withdrawn from the account until
    t = 4.)

    a. $13,719.39
    b. $17,954.13
    c. $19,570.00
    d. $21,430.45
    e. $22,436.12

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

55. You just put $1,000 in a bank account which 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

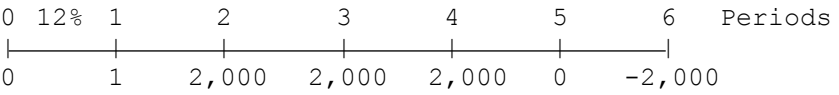
FV of lump sum and annuity **Answer: e Diff: M**

56. You are interested in saving money for your first house. Your plan is to make regular deposits into a brokerage account which 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

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

57. 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**

58. 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

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

59. 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 which 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

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

60. Foster Industries has a project which 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% 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**

61. 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:

End of Year	Cash Flow
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

Amortization **Answer: c Diff: M**

62. 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

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

63. Steaks Galore needs to arrange financing for its expansion program. One bank offers to lend the required $1,000,000 on a loan which 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%

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

64. You are willing to pay $15,625 to purchase a perpetuity which 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

Tough:

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

65. Find the present value of an income stream which 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

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

66. 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 at which 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**

67. 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, i.e., the first contribution will be made at the end of the year and the final contribution will be made at the time the oldest child enters college.

    The money will be invested in securities that are certain to earn a return of 8 percent each year. The oldest 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. $ 5,071.63
    c. $12,507.29
    d. $ 5,329.45
    e. $ 4,944.84

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

68. 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

Amortization **Answer: b Diff: T**

69. 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 which 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, i.e., to meet the interest and principal repayment requirements?

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

Financial Calculator Section

Multiple Choice: Problems

Easy:

Solving for N for an annuity **Answer: b Diff: E**

70. You are currently investing your money in a bank account which has a nominal annual rate of 9 percent, compounded monthly. If you invest $900 at the end of each month, how many months will it take for your account to grow to $301,066.27 (rounded to the nearest month)?

a. 40 months
b. 168 months
c. 175 months
d. 221 months
e. 335 months

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

71. 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%

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

72. 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%

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

73. You are currently investing your money in a bank account which 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 years
b. 9.15 years
c. 9.50 years
d. 9.93 years
e. 10.25 years

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

74. 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

Interest rate of an annuity **Answer: b Diff: E**

75. 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%

Medium:

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

76. 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%

Number of periods for an annuity **Answer: a Diff: M**

77. 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 a sum **Answer: d Diff: M**

78. 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 of annuity due **Answer: d Diff: M**

79. 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 an annuity **Answer: c Diff: M**

80. 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

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

81. You have just borrowed $20,000 to buy a new car. The loan agreement calls for 60 monthly payments of $444.89 each to begin one month from today. If the interest is compounded monthly, then what is the effective annual rate on this loan?

a. 12.68%
b. 14.12%
c. 12.00%
d. 13.25%
e. 15.08%

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

82. 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%

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

83. A baseball player is offered a 5-year contract which 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 which 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

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

84. 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 which 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

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

85. Steven just deposited $10,000 in a bank account which 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**

86. 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 (i.e., 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 non-annual compounding **Answer: d Diff: M**

87. 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 buys 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. None of the answers above is correct.

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

88. 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

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

89. You have just bought a security which pays $500 every six months. The security lasts for ten years. Another security of equal risk also has a maturity of ten 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**

90. 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

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

91. You recently purchased a 20-year investment which 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. The investment cost you $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**

92. A ten-year security generates cash flows of $2,000 a year at the end of each of the next three years (t = 1, 2, 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, 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**

93. 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 the 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: d Diff: M**

94. You have just bought a house and have a $125,000, 25-year mortgage with a fixed interest rate of 8.5 percent with monthly payments. Over the next five years, what percentage of your mortgage payments will go toward the repayment of principal?

a. 8.50%
b. 10.67%
c. 12.88%
d. 14.93%
e. 17.55%

Amortization **Answer: a Diff: M**

95. 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**

96. 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 repayment of interest?

a. 89.30%
b. 91.70%
c. 92.59%
d. 93.65%
e. 94.76%

Amortization **Answer: b Diff: M**

97. 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 balance on the loan 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 the remaining balance be on the loan after he makes the 36^{th} payment?

a. $7,915.56
b. $5,927.79
c. $4,746.44
d. $4,003.85
e. $5,541.01

Amortization **Answer: c Diff: M**

98. 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 balance on mortgage **Answer: c Diff: M**

99. You have a $175,000, 30-year mortgage with a 9 percent nominal rate. You make payments every month. What will be the remaining balance on your mortgage after 5 years?

a. $ 90,514.62
b. $153,680.43
c. $167,790.15
d. $173,804.41
e. $174,514.83

Remaining balance on mortgage **Answer: d Diff: M**

100. 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 balance on mortgage **Answer: d Diff: M**

101. 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

Tough:

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

102. 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 which has, in the first year, the same purchasing power as $40,000 has today. However, his retirement income will be of 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**

103. 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: a Diff: T**

104. Your client just turned 75 years old and plans on retiring in 10 years on her 85th birthday. She is saving money today for her retirement and is establishing a retirement account with your office. She would like to withdraw money from her retirement account on her birthday each year until she dies. She would ideally like to withdraw $50,000 on her 85th birthday, and increase her withdrawals 10 percent a year through her 89th birthday (i.e., she would like to withdraw $73,205 on her 89th birthday). She plans to die on her 90th birthday, at which time she would like to leave $200,000 to her descendants. Your client currently has $100,000. You estimate that the money in the retirement account will earn 8 percent a year over the next 15 years.

Your client plans to contribute an equal amount of money each year until her retirement. Her first contribution will come in 1 year; her 10th and final contribution will come in 10 years (on her 85th birthday). How much should she contribute each year to meet her objectives?

a. $12,401.59
b. $12,998.63
c. $13,243.18
d. $13,759.44
e. $14,021.53

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 (i.e., 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: c Diff: T**

107. 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 which 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 which 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**

108. 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 twelve 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 which 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**

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

- Assume that today's date is September 1.
- 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 $10,000 if you start now, and $10,600 if you start next September 1).
- Their daughter will enter college 15 years from now. 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 of the year she enters college (Year 15). The final payment will be made on September 1 of her last year in college (Year 18). 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 the September 1 after she graduates (i.e., at Year 19) 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 one year from now (i.e., at Year 1) and the final contribution will be made on September 1 when she enters college (i.e., Year 15).
- 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: b Diff: T**

110. Jim and Nancy are interested in saving money for their son's education. Today is their son's 8th birthday. Their son will enter college ten years from now on his 18th birthday, and will attend for four years. All college costs are due at the *beginning* of the year, so Jim and Nancy will have to make payments on their son's 18th, 19th, 20th and 21st birthdays (t = 10, 11, 12, 13). They estimate that the college their son wants to attend will cost $35,000 the first year (t = 10) and that the costs will increase 7 percent each year (the final college payment will be made 13 years from now).

Currently, Jim and Nancy have $20,000 in an investment account. They also plan to contribute a fixed amount at the end of each of the next ten years (t = 1, 2, 3, ... 10). Their invested money will be in an account which pays 9 percent interest compounded annually. How much money do Jim and Nancy need to contribute to the account in each of the next ten years?

a. $5,638
b. $5,848
c. $6,052
d. $6,854
e. $7,285

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. David will begin college in 15 years, and Daniel will begin in 16 years. Each will graduate after four years in college. 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% per year. Joe and June will now begin adding to this fund on every birthday, beginning next year, 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

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

112. To save money for a new house, you want to begin contributing money to a brokerage account. Your plan is to make ten 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, i.e., 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**

113. 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 plans 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:

Year	Cost per child	Children in college
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 forty 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**

114. You have some money on deposit in a bank account which 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 which 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%

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

115. 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. Any one, since they all have the same present value.
e. Choice 1, if the payments were made at the end of each month.

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

116. 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

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

117. 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 which 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

Extensions

Multiple Choice: Problems

Easy:

PV continuous compounding **Answer: b Diff: E**

2E-118. 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**

2E-119. 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**

2E-120. In order to purchase your first home you need a downpayment 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**

2E-121. 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**

2E-122. 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**

2E-123. If you have $5,438 in an account that has been paying an annual rate of 10 percent, compounded continuously, since you deposited some funds 10 years ago, how much was the original deposit?

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

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

2E-124. 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**

2E-125. 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**

2E-126. 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 2
ANSWERS AND SOLUTIONS

1. PV versus FV **Answer: b Diff: E**

2. PV versus FV **Answer: a Diff: E**

3. Amortization **Answer: a Diff: E**

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

5. Retirement and compounding **Answer: a Diff: E**

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

7. PV of a sum **Answer: a Diff: M**

8. Compounding **Answer: b Diff: M**

9. Comparative compounding **Answer: a Diff: M**

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

11. Effective and nominal rates **Answer: b Diff: M**

12. Periodic and nominal rates **Answer: a Diff: M**

13. Lump sum and annuity **Answer: b Diff: M**

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

15. PV versus FV **Answer: e Diff: E**

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

17. 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.

18. 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.

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

Statement d is correct. The equation for EAR is as follows:

$$EAR = \left(1+\frac{r_{Nom}}{m}\right)^{m} - 1$$

If annual compounding is used, m = 1 and the equation above reduces to EAR = r_{Nom}. The equation for the periodic rate is:

$$r_{PER} = \frac{r_{Nom}}{m}.$$

If annual compounding is used then m = 1 and $r_{PER} = r_{Nom}$, and since EAR = r_{Nom} then r_{PER} = EAR.

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

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

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

Statement d is correct; the other statements are incorrect. 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.

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

22. 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.

23. 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.

24. 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.

25. 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.

26. Time value concepts **Answer: e Diff: M**

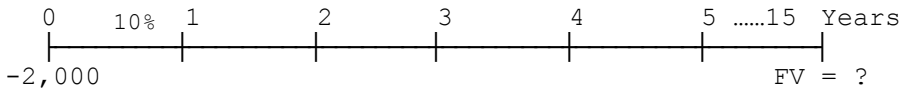
27. Time value concepts **Answer: c Diff: M**

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.

28. Time value concepts **Answer: d Diff: T**

29. FV of a single payment **Answer: d Diff: E**

Time Line:

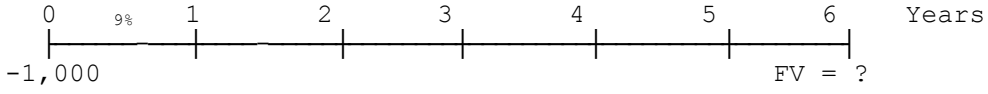


Numerical solution:
FV = $2,000(1.10^{15}) = $1,000(4.1772) = $8,354.50.

Financial calculator solution:
Inputs: N = 15; I = 10; PV = -2,000; PMT = 0.
Output: FV = $8,354.50.

30. FV of a single payment **Answer: c Diff: E**

Time Line:

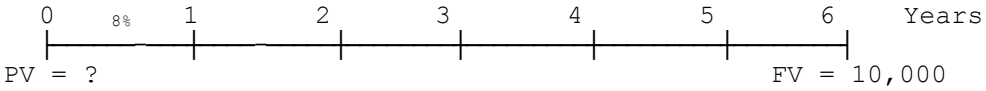


Numerical solution:
FV = $1,000(1.09^{6}) = $1,000(1.6771) = $1,677.10.

Financial calculator solution:
Inputs: N = 6; I = 9; PV = -1,000; PMT = 0.
Output: FV = $1,677.10.

31. PV of a single payment **Answer: b Diff: E**

Time Line:

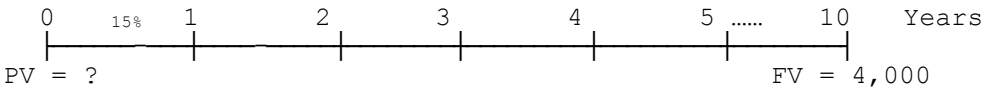


Numerical solution:
PV = $10,000 /(1.08^{6}) = $10,000 /(1.5869) = $6,301.70.

Financial calculator solution:
Inputs: N = 6; I = 8; PMT = 0; FV = -10,000.
Output: FV = $6,301.70.

32. PV of a single payment **Answer: e Diff: E**

Time Line:

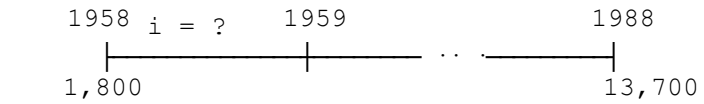


Numerical solution:
PV = $4,000 /(1.15^{10}) = $4,000 /(4.0456) = $988.74.

Financial calculator solution:
Inputs: N = 10; I = 15; PMT = 0; FV = -4,000.
Output: FV = $988.74.

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

Time Line:

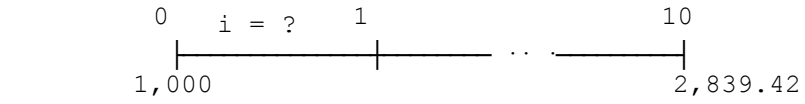


Numerical solution:
$13,700 = $1,800(1+i)^{30}
(1+i)^{30}=13,700/1,800=7.6111
(1+i)=7.6111$^{(1/30)}$ = 1.070
i ≈ 7%.

Financial calculator solution:
Inputs: N = 30; PV = -1,800; PMT = 0; FV = 13,700. Output: I = 7.0%.

34. Solving for the interest rate for a single payment Answer: e Diff: E

Time Line:

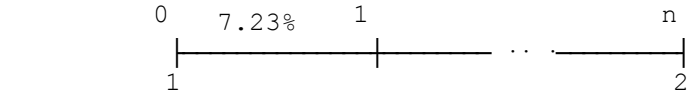


Numerical solution:
$2,839.42 = $1,000(1+i)^{10}
$(1+i)^{10}=2,839.42/1,000=2.8394$
$(1+i)=2.8394^{(1/10)} = 1.11$
i ≈ 11%.

Financial calculator solution:
Inputs: N = 10; PV = -1,000; PMT = 0; FV = 2,839.42. Output: I = 11.0%.

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

Time Line:



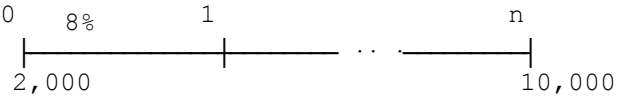
Numerical solution:
$2= 1(1+0.0723)^{n}$
$(1+0.0723)^{n}=2$
n ln[1.0723]=ln[2]
n = ln[2]/ ln[1.0723]
n = 0.6931 / 0.0698 = 9.93.

Financial calculator solution:

PV = -1
FV = 2
PMT = 0
I = 7.23
N = ? = 119.17 months = 9.93 years.

36. Solving for N for a single payment **Answer: b Diff: E**

Time Line:



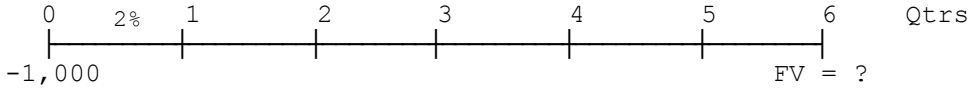
Numerical solution:
$10,0000 = 2,000(1+0.08)^n$
$(1+0.08)^n = 10,000/2,000 = 5$
$n \ln[1.08] = \ln[5]$
$n = \ln[5] / \ln[1.08]$
$n = 1.6094 / 0.0770 = 20.91.$

Financial calculator solution:

PV = -2,000
FV = 10,000
PMT = 0
I = 8
N = ? = 20.91 years.

37. FV of a sum **Answer: b Diff: E**

Time Line:

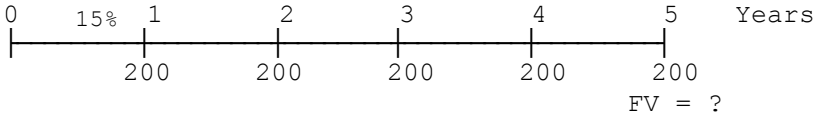


Numerical solution:
$FV = \$1,000(1.02^6) = \$1,000(1.1262) = \$1,126.20 \approx \$1,126.$

Financial calculator solution:
Inputs: N = 6; I = 2; PV = -1,000; PMT = 0.
Output: FV = $1,126.16 ≈ $1,126.

38. FV of an annuity **Answer: e Diff: E**

Time Line:

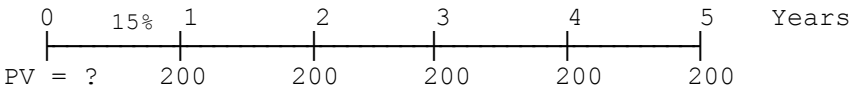


Numerical solution:
$FV = \$200((1.15^5 - 1)/.15)) = \$200 \times 6.7424 = \$1,348.48.$

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

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

Time Line:



Numerical solution:
PV = $200((1-(1/1.15^5))/.15) = $200 × 3.3522 = $670.44.

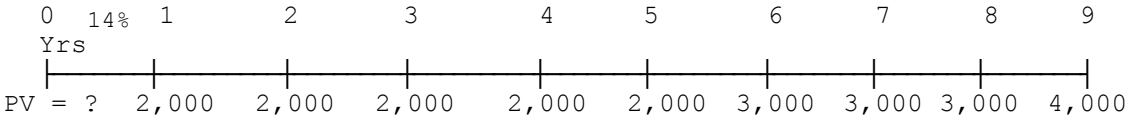
Financial calculator solution:
Inputs: N = 5; I = 15; PMT = 200; FV = 0. Output: PV = -$670.43.

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

V = PMT/i = $1,000/0.15 = $6,666.67.

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

Time Line:

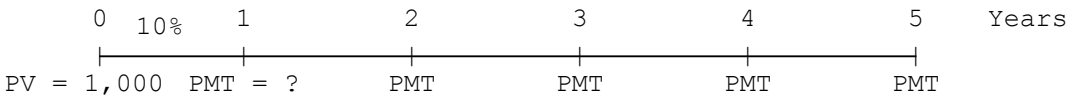


Numerical solution:
PV = $2,000((1-(1/1.14^5))/.14) + $3,000([(1-(1/1.14^3))/.14] [1/1.14^5]) + $4,000(1.14^9)
= $2,000(3.4331) + $3,000(2.3216)(0.5194) + $4,000(0.3075)
= $6,866.20 + $3,617.52 + $1,230.00 = $11,713.72 ≈ $11,714.

Financial calculator solution:
Using cash flows
Inputs: CF_0 = 0; CF_1 = 2,000; N_j = 5; CF_2 = 3,000; N_j = 3; CF_3 = 4,000; I = 14.
Output: NPV = $11,713.54 ≈ $11,714.

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

Time Line:

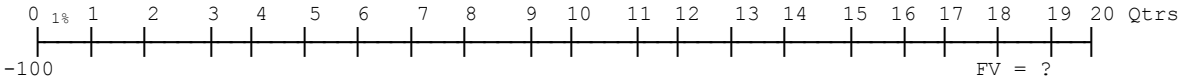


Numerical solution:
$1,000 = PMT((1-(1/1.1^5))/.1)
PMT = $1,000/3.7908 = $263.80.

Financial calculator solution:
Inputs: N = 5; I = 10; PV = -1,000; FV = 0. Output: PMT = $263.80.

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

Time Line:

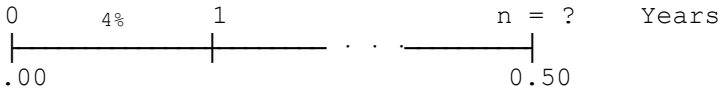


Numerical solution:
$\$100(1.01^{20}) = \$100(1.2202) = \$122.02.$

Financial calculator solution:
Inputs: N = 20; I = 1; PV = -100; PMT = 0. Output: FV = $122.02.

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

Time Line:



Numerical solution:
$0.5 = \$1(1/1.04^{n})$
$(1.04)^{n} = 1/0.5 = 2$
n LN(1.04) = LN(2)
n = 0.6931 / 0.0392
n = 17.68 ≈ 18 years.

Financial calculator solution:
Inputs: I = 4; PV = -1; PMT = 0; FV = 0.50.
Output: N = -17.67 ≈ 18 years.

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

Bank A: 8%, monthly.

$$EAR_A = \left(1+\frac{r_{Nom}}{m}\right)^{m} - 1$$

$$= \left(1 + \frac{0.08}{12}\right)^{12} - 1 = 8.30\%.$$

Bank B: 9%, interest due at end of year
$EAR_B = 9\%.$

9.00% - 8.30% = 0.70%.

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

Use the formula for calculating effective rates from nominal rates as follows:
EAR = $(1 + 0.18/12)^{12} - 1 = 0.1956$ or 19.56%.

47. Effective annual return **Answer: b Diff: E**

Convert each of the alternatives to an effective annual rate (EAR) for comparison.
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.

48. Effective annual return **Answer: a Diff: E**

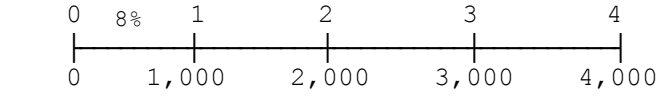
Convert each of the alternatives to an effective annual rate (EAR) for comparison.
a. EAR = 10.2736%.
b. EAR = 10.1846%.
c. EAR = 10.2000%.
d. EAR = 10.2500%.
e. EAR = 10.0339%.
Therefore, the highest effective return is choice a.

49. Effective annual return **Answer: b Diff: E**

Convert each of the alternatives to an effective annual rate (EAR) for comparison.
a. NOM% = 9; P/YR = 2; EFF% = EAR = 9.20%.
b. EAR = 9.31%.
c. EAR = 9.20%.
d. EAR = 9.27%.
e. EAR = 9.20%.
Thus, b provides the investor with the highest EAR.

50. PV of an uneven CF stream **Answer: d Diff: E**

Time Line:



Numerical solution:
PV = $1,000(1/1.08^1) = $ 925.926
+$2,000(1/1.08^2) = $1,714.678
+$3,000(1/1.08^3) = $2,381.497
+$4,000(1/1.08^4) = $2,940.119
PV = $7,962.22

Financial calculator solution:
Inputs: CF_0 = 0; CF_1 = 1,000; CF_2 = 2,000; CF_3 = 3,000; CF_4 = 4,000; I = 8.
Output: NPV = $7,962.22.

51. Interest payment on an amortized loan **Answer: b Diff: E**

Solve for the payment as follows:
N = 5
I = 10
PV = -100,000
FV = 0
Solve for PMT = $26,379.748.

Interest in Year 1 is $10,000 = 0.10($100,000).
Principle in Year 1 is $16,379.748 = $26,379.748 - $10,000.
Beginning balance in Year 1 is $83,620.252 = $100,000 - $16,379.748.
Interest in Year 2 is $8,362 = 0.10($83,620.252).

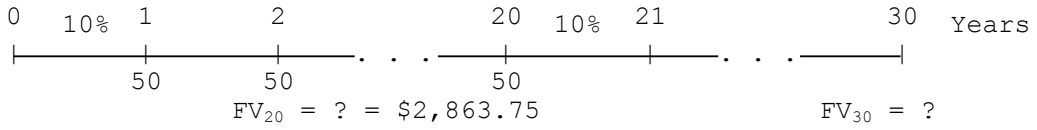
52. Effective annual rate **Answer: c Diff: E**

$EAR = (1+(0.15/12))^{12} - 1.0 = 1.1608 - 1.0 = 0.1608 = 16.08\%$.

Financial calculator solution:
Inputs: P/YR = 12; NOM% = 15.0. Output: EFF% = EAR = 16.08%.

53. FV of an annuity **Answer: b Diff: M**

Time Line:



Numerical solution:
$FV_{Year\ 20} = \$50[(1.1^{20}-1)/.1] = \$50(57.275) = \$2,863.75$.
$FV_{Year\ 30} = \$2,863.75[1.1^{10}] = \$2,863.75(2.5937) = \$7,427.71$.

Financial calculator solution:
Calculate FV at Year 20, take that lump sum forward 10 years to Year 30 at 10%.
Inputs: N = 20; I = 10; PV = 0; PMT = -50. $Output_{Year\ 20}$: FV = $2,863.75.
At Year 30
Inputs: N = 10; I = 10; PV = -2,863.75; PMT = 0.
$Output_{Year\ 30}$: FV = $7,427.83.

54. FV of annuity due **Answer: b Diff: M**

One of the several ways of doing this is to treat this as a 4-year annuity due plus a payment in Year 4.

Numerical solution:
$\$3,000[(1.09^4-1)/.09]\ (FVIFA_{9\%,4})(1.09) + \$3,000$
$\$3,000(4.5731)(1.09) + \$3,000 = \$17,954.04.$

Financial calculator solution:
BEGIN Mode
N = 4
I = 9
PV = 0
PMT = -3,000
FV = $14,954.13.
Plus the $3,000 at the end of Year 4 = $14,954.13 + $3,000 = $17,954.13.

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

Numerical solution:
$\$1,000(1.005)^{36} = \$1,196.68.$

Financial calculator solution:
N = 3 × 12 = 36
I = 6/12 = 0.5
PV = -1,000
PMT = 0
Solve for FV = $1,196.68.

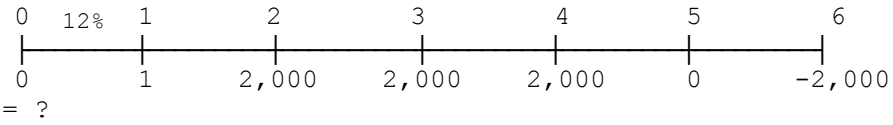
56. FV of lump sum and annuity **Answer: e Diff: M**

Numerical solution:
$PMT_0 = \$5,000$; $PMT_1 = \$5,000 \times 1.10 = \$5,500$; $PMT_2 = \$5,000 \times (1.10)^2 = \$6,050$; $PMT_3 = \$5,000 \times (1.10)^3 = \$6,655$; $PMT_4 = \$5,000 \times (1.10)^4 = \$7,320.50$.
$FV = \$5,000(1.14)^5 + \$5,500(1.14)^4 + \$6,050(1.14)^3 + \$6,655(1.14)^2 + \$7,320.50(1.14) = \$44,873.90.$

Financial calculator solution:
First, calculate the payment amounts:
$PMT_0 = \$5,000$, $PMT_1 = \$5,500$, $PMT_2 = \$6,050$, $PMT_3 = \$6,655$, $PMT_4 = \$7,320.50$. Then, find the future value of each payment at t = 5: For PMT_0, N = 5, I = 14, PV = -5,000, 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.

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

Time Line:



Numerical solution:

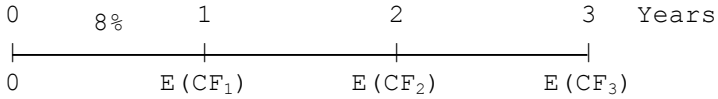
PV = +\$1(1/1.12^1) = \$1(0.8929) = \$ 0.89
+\$2,000(1/1.12^2) = \$2,000(0.7972) = \$1,594.40
+\$2,000(1/1.12^3) = \$2,000(0.7118) = \$1,423.60
+\$2,000(1/1.12^4) = \$2,000(0.6355) = \$1,271.00
-\$2,000(1/1.12^5) = -\$2,000(0.5066) = -\$1,013.20
PV = \$3,276.69

Financial calculator solution:
Inputs: $CF_0 = 0$; $CF_1 = 1$; $CF_2 = 2{,}000$; $N_j = 3$ times; $CF_3 = 0$; $CF_4 = -2{,}000$; $I = 12$.
Output: NPV = \$3,276.615 ≈ \$3,277.

Note: Numerical solution differs from calculator solution due to interest factor rounding.

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

Time Line:



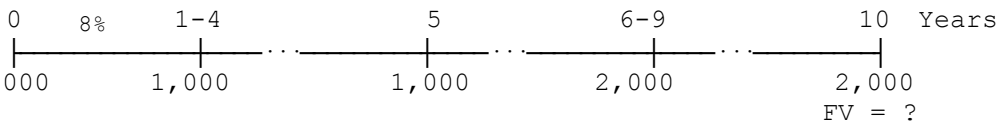
Calculate expected cash flows
$E(CF_1)$ = (0.30)(\$300) + (0.40)(\$500) + (0.30)(\$700) = \$500.
$E(CF_2)$ = (0.15)(\$100) + (0.35)(\$200) + (0.35)(\$600) + (0.15)(\$900) = \$430.
$E(CF_3)$ = (0.25)(\$200) + (0.75)(\$800) = \$650.

Numerical solution:
PV = \$500(1/1.08^1) + \$430(1/1.08^2) + \$650(1/1.08^2)
= \$500(0.9259) + \$430(0.8573) + \$650(0.7938)
= \$462.95 + \$368.64 + \$515.97 = \$1,347.56.

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.

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

Time Line:



Numerical solution:

$FV = \$1{,}000(FVIFA_{8\%,10}) + \$1{,}000(FVIFA_{8\%,5}) + \$5{,}000(FVIF_{8\%,10})$

$= \$1{,}000((1.08^{10}-1)/.08) + \$1{,}000((1.08^{5}-1)/.08) + \$5{,}000(1.08^{10})$

$= \$1{,}000(14.487) + \$1{,}000(5.866) + \$5{,}000(2.1589)$

$= \$14{,}487 + \$5{,}866 + \$10{,}794.50 = \$31{,}147.50 \approx \$31{,}148.$

Financial calculator solution:

Solution using NFV: (*Note:* Some calculators do not have net future value function. Cash flows can be grouped and carried forward or PV can be used; see alternative solution below.)

Inputs: $CF_0 = 5{,}000$; $CF_1 = 1{,}000$; $N_j = 5$; $CF_2 = 2{,}000$; $N_j = 5$; $I = 8$.

Output: NFV = \$31,147.79 ≈ \$31,148.

Alternative solution: Calculate PV of the cash flows, then bring them forward to FV using the interest rate.

Inputs: $CF_0 = 5{,}000$; $CF_1 = 1{,}000$; $N_j = 5$; $CF_2 = 2{,}000$; $N_j = 5$; $I = 8$.

Output: PV = \$14,427.45.

Inputs: N = 10; I = 8; PV = -14,427.45.

Output: FV = \$31,147.79 ≈ \$31,148.

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

Numerical solution:

$PV = -\$300 + (\$100)(0.8696) + (\$125.43)(0.7561) + (\$90.12)(0.6575)$

$PV = -\$58.95.$

Now, solve for CF_4:

$\$58.95(1.15)^4 = \$103.10.$

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.

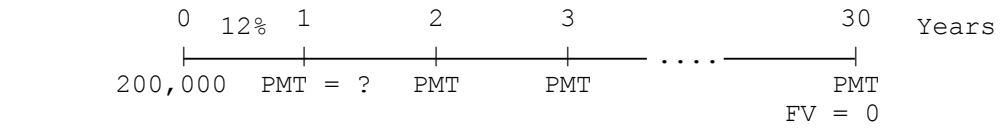
PV = -58.945; N = 4; I/YR = 15; PMT = 0; solve for FV = \$103.10.

61. 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.

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

Time Line:



Numerical solution:
Initial balance = 0.8(\$250,000) = \$200,000.
\$200,000 = PMT$(PVIFA_{12\%,30})$
\$200,000 = PMT$[(1-(1/1.12^{30})/0.12]$
\$200,000 = PMT(8.0552)
PMT = \$200,000/8.0552 = \$24,828.68 ≈ \$24,829.

Financial calculator solution:
Inputs: N = 30; I = 12; PV = -200,000; FV = 0.
Output: PMT = \$24,828.73 ≈ \$24,829.

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

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

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

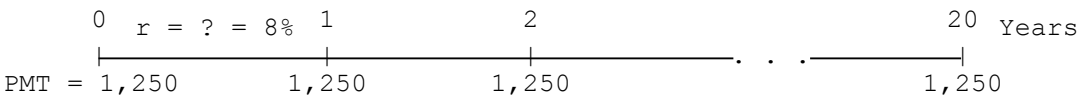
Difference = 10.38% - 9.42% = 0.96%.

Alternatively, with a financial calculator, for the quarterly loan enter P/YR = 4, NOM% = 10, and press EFF% to get EAR = 10.38%.

For the daily loan, enter P/YR = 365, NOM% = 9, and press EFF% to get EAR = 9.42%.

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

Time Line:



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

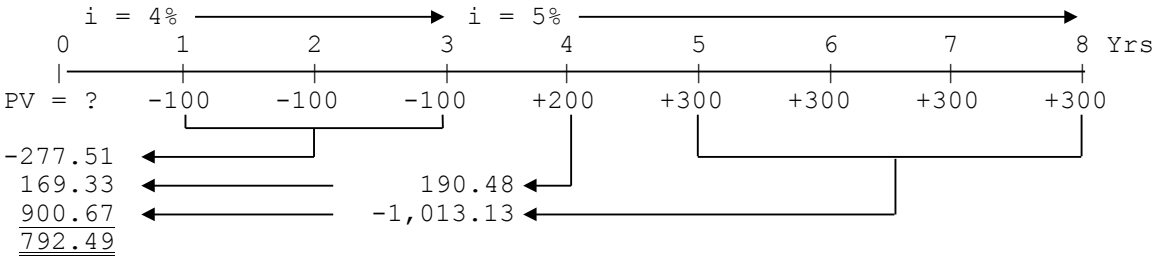
$$r = \frac{PMT}{V_p} = \frac{\$1,250}{\$15,625} = 8\%.$$

Tabular solution:
Calculate the value of the annuity using r = 8%
$V_{Annuity} = \$1,250[(1-(1/1.08^{20})/0.08] = \$1,250(9.8181) = \$12,272.63 \approx \$12,273.$

Financial calculator solution:
Inputs: N = 20; I = 8; PMT = -1,250. Output: PV = $12,272.68 ≈ $12,273.

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

Time line:



Numerical solution:

$PV = -\$100(PVIFA_{4\%,3}) + \$200(PVIF_{5\%,1})(PVIF_{4\%,3}) + \$300(PVIFA_{5\%,4})(PVIF_{5\%,1})(PVIF_{4\%,3})$

$= -\$100[(1-(1/1.04^3)/.04] + \$200(1/1.05)(1/1.04^3) + \$300[(1-(1/1.05^4)/.05](1/1.05)(1/1.04^3)$

$= -\$100(2.7751) + \$200(0.9524)(0.8890) + \$300(3.5460)(0.9524)(0.8890)$

$= -\$277.51 + \$169.34 + \$900.70 = \$792.53.$

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 = -1,203.60. Output: PV = $1,070.

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

Note: Numerical solution differs from calculator solution due to interest factor rounding.

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

College Cost Today = \$10,000, Inflation = 5%.

$CF_0 = \$10,000 \times (1.05)^5 = \$12,762.82 \times 1 = \$12,762.82.$

$CF_1 = \$10,000 \times (1.05)^6 = \$13,400.96 \times 1 = \$13,400.96.$

$CF_2 = \$10,000 \times (1.05)^7 = \$14,071.00 \times 2 = \$28,142.00.$

$CF_3 = \$10,000 \times (1.05)^8 = \$14,774.55 \times 2 = \$29,549.10.$

$CF_4 = \$10,000 \times (1.05)^9 = \$15,513.28 \times 1 = \$15,513.28.$

$CF_5 = \$10,000 \times (1.05)^{10} = \$16,288.95 \times 1 = \$16,288.95.$

Numerical solution:

Find PV of college costs in Year 5:

PV = \$12,762.82 + \$13,400.96(0.9259) + \$28,142(0.8573) +
\$29,549.10(0.7938) + \$15,513.28(0.7350) + \$16,288.95(0.6806)
= \$95,241.50.

Find FV of educational fund in 5 years:

$\$50,000(1.08)^5 = \$73,466.40.$

Now, find net amount needed in Year 5:

\$95,241.50 – \$73,466.40 = \$21,775.10.

Finally, find PMT needed to accumulate \$21,775.10 in Year 5:

$FVA_5 = PMT(FVIFA_{8\%,5})$

$\$21,775.10 = PMT[(1.08^5-1)/0.08]$

\$21,775.10 = PMT(5.8666)

PMT = \$3,711.71.

Note: Numerical solution differs from calculator solution due to interest factor rounding.

Financial calculator solution:

Enter cash flows in CF register:

I = 8; solve for NPV = \$95,244.08.

Calculate annuity:

N = 5
I = 8
PV = -50,000
FV = 95,244.08
PMT = ? = \$3,712.15.

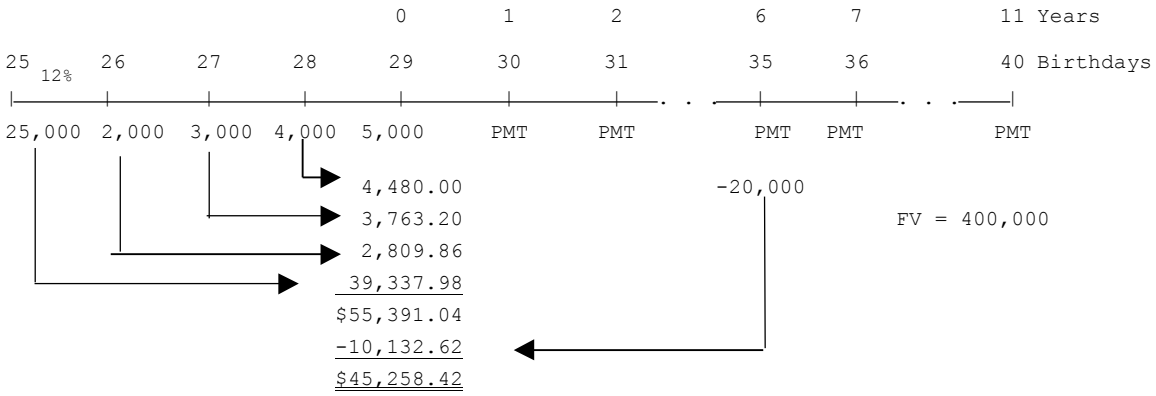
67. Required annuity payments **Answer: b Diff: T**

Numerical solution:
Calculate the present value of college costs at t = 16:
PV = $25,000(0.9259) + $25,000(0.8573) + $50,000(0.7938) +
$50,000(0.7350) + $25,000(0.6806) + $25,000(0.6302)
PV = $153,790.
Calculate the annual required deposit:
$FVA_{16} = PMT(FVIFA_{8\%,16})$
$\$153,790 = PMT[(1.08^{16}-1)/0.08]\ (30.324)$
$\$153,790 = PMT(30.324)$
PMT = $5,071.56.
Note: Numerical solution differs from calculator solution due to interest factor rounding.

Financial calculator solution:
Step 1 Calculate the present value of college costs at t = 16:
Remember, costs are incurred at end of year.
t = 16: $CF_0 = 0$
t = 17: $CF_1 = 25,000$
t = 18: $CF_2 = 25,000$
t = 19: $CF_3 = 50,000$
t = 20: $CF_4 = 50,000$
t = 21: $CF_5 = 25,000$
t = 22: $CF_6 = 25,000$
I = 8; Solve for NPV = $153,793.54.

Step 2 Calculate the annual required deposit:
N = 16
I = 8
PV = 0
FV = -153,793.54
Solve for PMT = $5,071.63.

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



Step 1 Compound cash flows from birthdays 25, 26, 27, and 28 to 29th birthday:
$\$25{,}000(1.12)^4 + \$2{,}000(1.12)^3 + \$3{,}000(1.12)^2 + \$4{,}000(1.12) + \$5{,}000(1.12)^0$
= \$39,337.98 + \$2,809.86 + \$3,763.20 + \$4,480.00 + \$5,000.00
= \$55,391.04.

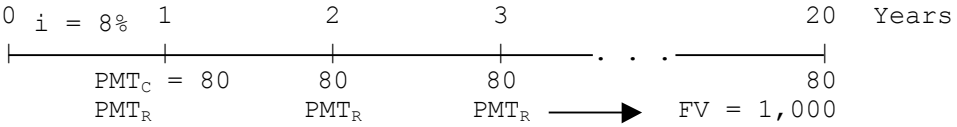
Step 2 Discount \$20,000 withdrawal back to 29th birthday (6 years): N = 6; I = 12; PMT = 0; FV = 20000; solve for PV. PV = \$10,132.62. (Remember to add minus sign as this is a withdrawal.)

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; solve for PMT.
PMT = \$11,743.95.

69. Amortization **Answer: b Diff: T**

Time Line: (In thousands)



Annual PMT Total = PMT_{Coupon} + $PMT_{Reserve}$ = \$80,000 + $PMT_{Reserve}$.

Numcerical solution:
Long way
Annual interest: 0.08(\$1,000,000) = \$80,000.
Annual reserve: FV = \$1,000,000 = PMT($FVIFA_{8\%,20}$) =
PMT[$(1.08^{20}-1)/0.08$]=PMT(45.762).
PMT = \$1,000,000/45.762 = \$21,852.19 ≈ \$21,852 per year.
Total annual payment: \$80,000 + \$21,852 = \$101,852.
Total number of tickets = \$101,852/\$10 ≈ 10,186.*
*Rounded up to next whole ticket.
Short way
PV = \$1,000,000 = PMT($PVIFA_{8\%,20}$) = PMT[$(1-(1/1.08^{20})/0.08$]=PMT(9.8181).
PMT = \$1,000,000/9.8181 = \$101,852.70.
Note: Short way works only if bond yield = investment rate.

Financial calculator solution:
Long way Inputs: N = 20; I = 8; FV = 1,000,000.
Output: PMT = -\$21,852.21.
Add coupon interest and reserve payment together
Annual PMT_{Total} = \$80,000 + \$21,852.21 = \$101,852.21.
Total number of tickets = \$101,852.21/\$10.00 = 10,185.22 ≈ 10,186.*
*Rounded up to next whole ticket.
Short way Inputs: N = 20; I = 8; PV = 1,000,000; FV = 0.
Output: PMT = -\$101,852.21.
Total number of tickets = \$101,852.21/\$10.00 ≈ 10,186.*
*Rounded up to next whole ticket.

70. Solving for N for a single payment **Answer: b Diff: E**

Financial calculator solution:

PV = 0
FV = 301,066.27
PMT = -900
I = 9/12 = 0.75
N = ? = 168 months.

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

1st investment Enter the following:
NOM% = 9
P/YR = 2
Solve for EFF% = 9.2025%.

2nd investment Enter the following:
EFF% = 9.2025
P/YR = 4
Solve for NOM% = 8.90%.

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

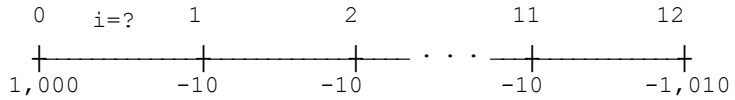
Your proposal:
EAR_1 = \$120/\$1,000
EAR_1 = 12%.

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 r_{Nom} = 12%:

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

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 solve for EFF% = 12.68%.

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

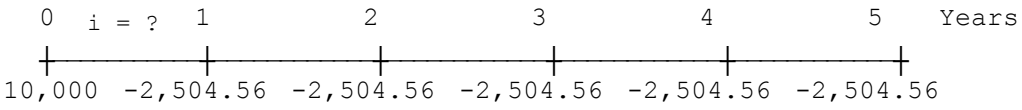
PV = -1
FV = 2
PMT = 0
I = 7/12
N = ? = 119.17 months = 9.93 years.

74. Monthly payments on loan **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 = -13,000, FV = 0, and solve for PMT = \$276.21.

75. Interest rate of an annuity **Answer: b Diff: E**

Time Line:

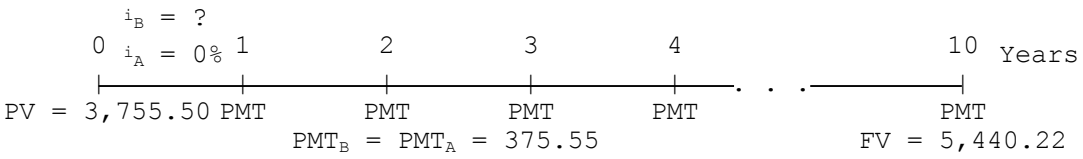


Tabular solution:
$10,000 = $2,504.56($PVIFA_{i,5}$)
$PVIFA_{i,5}$ = $10,000/$2,504.56 = 3.9927
i = 8%.

Financial calculator solution:
Inputs: N = 5; PV = 10,000; PMT = -2,504.56; FV = 0. Output: I = 8%.

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

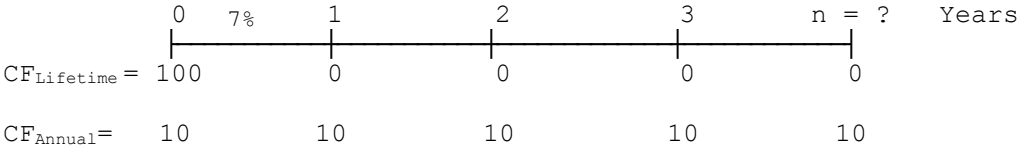
Time Line:



Financial calculator solution:
Calculate the PMT of the annuity
Inputs: N = 10; I = 0; PV = -3,755.50; FV = 0. Output: PMT = $375.55.
Calculate the effective annual interest rate
Inputs: N = 10; PV = 0; PMT = -375.55; FV = 5,440.22.
Output: I = 7.999 ≈ 8.0%.

77. Number of periods for an annuity **Answer: a Diff: M**

Time Line:

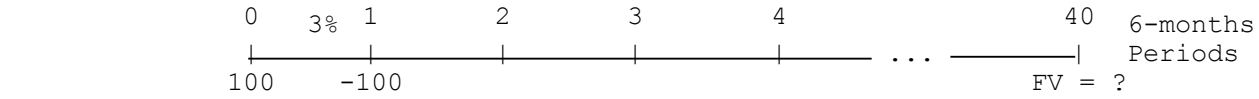


Tabular solution:
Set $PV_{Lifetime}$ = PV_{Annual}, solve for n.
$100 = $10 + $10($PVIFA_{7\%,n}$)
$90 = $10($PVIFA_{7\%,n}$)
9 = $PVIFA_{7\%,n}$
n ≈ 15 years.

Financial calculator solution:
Inputs: I = 7; PV = -90; PMT = 10; FV = 0. Output: N = 14.695 ≈ 15 years.

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

Time Line:



Tabular/Numerical solution:
Solve for amount on deposit at the end of 6 months.
Step 1 FV = \$100($FVIF_{3\%,1}$) - \$100 = \$3.00.
FV = \$100(1 + 0.06/2) - \$100 = \$3.00.
Step 2 *Compound the \$3.00 for 39 periods at 3%*
FV = \$3.00($FVIF_{3\%,39}$) = \$9.50.
Since table does not show 39 periods, use numerical/calculator exponent method.
FV = \$3.00$(1.03)^{39}$ = \$9.50.

Financial calculator solution: (Step 2 only)
Inputs: N = 39; I = 3; PV = -3.00; PMT = 0. Output: FV = \$9.50.

79. 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 = -3,000
FV = \$20,738.58

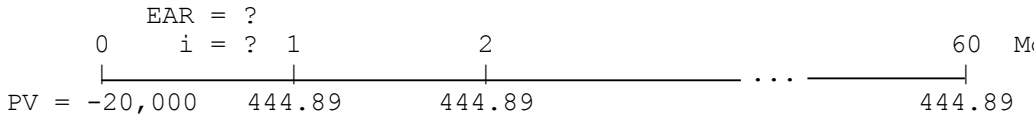
Now add on to this the last payment that occurs at t = 5.
\$20,738.58 + \$3,000 = \$23,738.58 ≈ \$23,739.

80. 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, and PMT = 3000. Solve for FV = \$894,380. Add the last payment of \$3,000, and the value at t = 35 is \$897,380.

81. Effective annual rate **Answer: a Diff: M**

Time Line:



Tabular solution:
$\$20,000 = \$444.89(PVIFA_{i,60})$
$PVIFA_{i,60} = 44.9549$
i = 1%.
$EAR = (1.01)^{12} - 1.0 = 1.12681 - 1.0 = 0.1268 = 12.68\%$.

Financial calculator solution:
Calculate periodic rate and nominal rate
Inputs: N = 60; PV = -20,000; PMT = 444.89; FV = 0.
Output: I = 1.0. NOM% = 1.0% × 12 = 12.00%.
Use interest rate conversion feature
Inputs: P/YR = 12; NOM% = 12.0. Output: EFF% = EAR = 12.68%.

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

Given: Loan Value = $12,000; Loan Term = 10 years (120 months); Monthly Payment = $150.

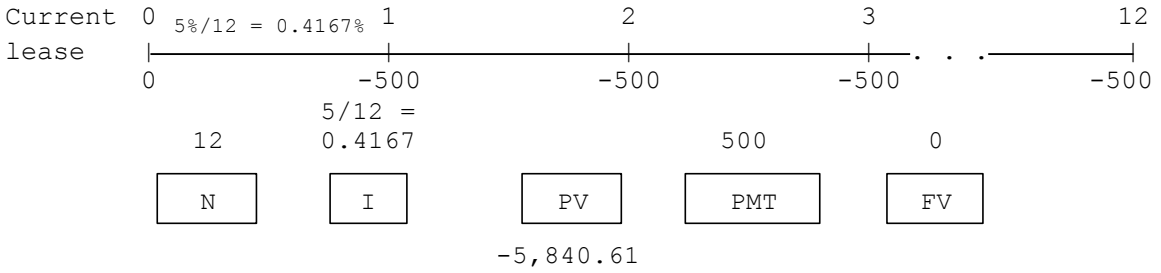
N = 120
PV = -12,000
PMT = 150
FV = 0
Solve for I/YR = 0.7241 × 12 = 8.6892%. However, this is a nominal rate. To find the effective rate, enter the following:
NOM% = 8.6892
P/YR = 12
Solve for EFF% = 9.0438%.

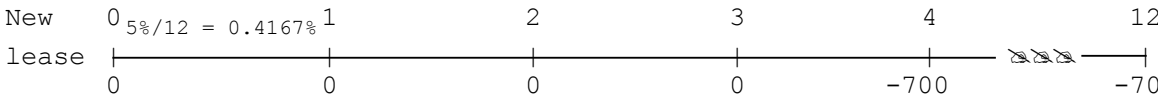
83. Required annuity payments **Answer: c Diff: M**

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; PMT = ? = $1.989 million.

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





$CF_0 = 0$
$CF_{1-3} = 0$
$CF_{4-12} = -700$
$I = 0.4167$
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.

85. 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, and PMT = 0.
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, and PMT = 0.
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, and PMT = 0.
Solve for FV = $22,537.

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

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

The answer is a. Solve for FV as N = 132, I = 4/365 = 0.0110, PV = -2,000, PMT = 0, and solve for FV = ? = $2,029.14.

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

First, find the FV of Josh's savings as: N = 2 × 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 × 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 = -1,500, 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.

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

The effective rate is given by:
NOM% = 8
P/YR = 4
Solve for EFF% = 8.2432%.

The nominal rate on a semiannual basis is given by:
EFF% = 8.2432
P/YR = 2
Solve for NOM% = 8.08%.

The future value is given by:
N = 2.5 × 2 = 5
I = 8.08/2 = 4.04
PV = 0
PMT = -100
Solve for FV = $542.07.

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

Start by calculating the effective rate on the second security:
P/YR = 12
NOM% = 10
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 × 2 = 20, I = 10.2107/2 = 5.1054, PMT = 500, FV = 0, thus, PV = -$6,175.82.

90. 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 × 3 = 6, I = 12.18/2 = 6.09, PMT = 500, FV = 0, and PV = ? = -$2,451.73.

91. 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 = -5,544.87
CF_1 = 100
CF_2 = 500
CF_3 = 750
I = 9; solve for NPV = -$4,453.15.

N = 3
I = 9
PV = -4,453.15
PMT = 0
FV = $5,766.96.

Now solve for X.
N = 17
I = 9
PV = -5,766.96
FV = 0
Solve for PMT = $675.

92. 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 = -24,307.85
PMT = 2,000
FV = $23,580.68.

Find the value of the final $10,000 at Year 3.
N = 7
I = 7.3
PMT = 0
FV = 10,000
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 = -17,474.05
FV = 0
PMT = $3,700.00.

93. 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 amount forward in time 3 years:
N = 3, I/YR = 10, PV = -2,518.41, PMT = 0, solve for FV = $3,352.00.
This amount is also the present value of the 17-year annuity.
N = 17, I/YR = 10, PV = -3,352, FV = 0, solve for PMT = $417.87.

94. Amortization **Answer: d Diff: M**

N = 25 × 12
I = 8.5/12
PV = -125,000
FV = 0
PMT = $1,006.53

Do amortization:
Enter: 1 INPUT 60 ■ AMORT
Interest = $51,375.85
Principal = $9,015.95
Balance = $115,984.05

Total Payments = 5 × 12 × $1,006.53
= $60,391.80.

$$\text{\% Repayment of principal} = \frac{\$9,015.95}{\$60,391.80} = 0.1493 = 14.93\%.$$

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

Given: Loan Value = $100,000; Repayment Period = 12 months;
Monthly Payment = $9,456.

N = 12
PV = -100,000
PMT = 9,456
FV = 0
Solve for I/YR = 2.00% × 12 = 24.00%.

To find the amount of principal paid in the third month (or period), use the calculator's amortization feature. Enter: 3 INPUT 3 ■ AMORT (to activate the calculator's amortization feature).
Interest = $1,698.84
Principal = $7,757.16
Balance = $77,181.86

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

We will use the amortization feature of the HP-10B.
Enter the loan details:
N = 30 × 12 = 360
I = 9/12 = 0.75
PV = -90,000
FV = 0
PMT = $724.16.

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

Now get the interest:
1 INPUT 24 ■ AMORT
Interest = $16,092.44
Percentage of first two years that is interest is:
$16,092.44/$17,379.85 = 0.9259 = 92.59%.

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

Find the payment of the mortgage first. N = 48; I/YR = 12/12 = 1; PV = 20000; FV = 0; solve for PMT. PMT = $526.6767. Now use the amortization feature of your calculator. Enter 1 INPUT 36, ■ AMORT. Then, press = 3 times for the remaining balance amount, which is $5,927.79.

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

First, find the payment: Enter N = 360, I/YR = 9/12 = 0.75, PV = -250,000, and FV = 0. Solve for PMT = $2,011.56. On your calculator, use the amortization feature by entering: 1 INPUT 60, ■ AMORT, and press the = 3 times. The remaining balance is $239,700.

99. Remaining balance on mortgage **Answer: c Diff: M**

Solve for the monthly payment as follows:
N = 30 × 12 = 360
I = 9/12 = 0.75
PV = -175,000
FV = 0
Solve for PMT = $1,408.09/month.

Use the calculator's amortization feature to find the remaining principal balance:
5 years = 5 × 12 = 60 payments.
1 INPUT 60 ■ AMORT
Interest = $77,275.55
Principal = $ 7,209.85
Balance = $167,790.15

100. Remaining balance on mortgage **Answer: d Diff: M**

Solve for the monthly payment as follows:
N = 30 × 12 = 360
I = 8/12 = 0.667
PV = -150,000
FV = 0
Solve for PMT = $1,100.65/month.

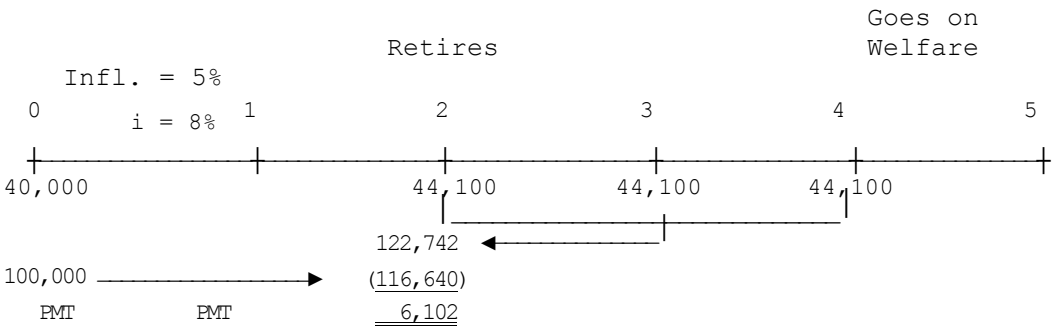
Use the calculator's amortization feature to find the remaining principal balance:
3 × 12 = 36 payments
1 INPUT 36 ■ AMORT
Interest = $ 35,543.52
Principal = $ 4,079.88
Balance = $145,920.12

101. Remaining balance on mortgage **Answer: d Diff: M**

Solve for the monthly payment as follows:
N = 12 × 15 = 180
I = 8.5/12 = 0.7083
PV = -160,000
FV = 0
PMT = $1,575.58.

Use the calculator's amortization feature to find the remaining principal balance:
1 INPUT 36 ■ AMORT
Interest = $ 38,658.34
Principal = $ 18,062.54
Balance = $141,937.46

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



Step 1 The retirement payments, which begin at t = 2, must be:
$40,000(1 + 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". Then enter:
N = 3; I = 8; PMT = 44,100; FV = 0. Solve for PV = $122,742.
If he has this amount at t = 2, he can receive the 3 retirement payments.

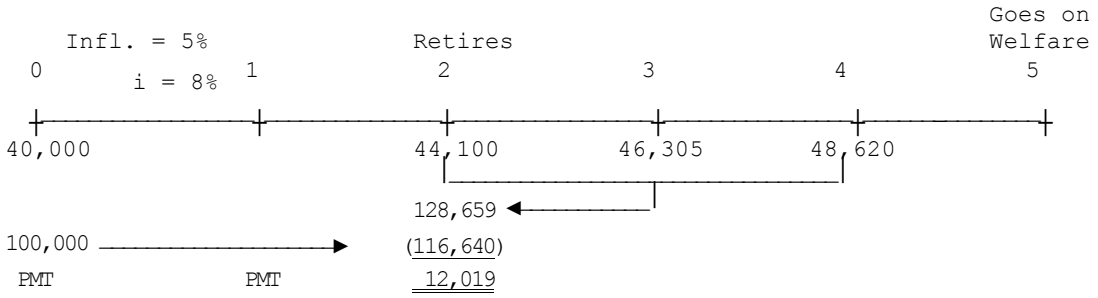
Step 3 The $100,000 now on hand will compound at 8% for 2 years:
$100,000(1.08)^2 = $116,640.

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	(116,640)
Net additional needed	$ 6,102

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". Then enter:
N = 2; I = 8; PV = 0; FV = 6,102. Solve for PMT = $2,716.

103. 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 = 44,100.
CF_1 = 46,305.
CF_2 = 48,620.
Then enter I = 8, and press ■ NPV to find NPV = PV = $128,659.

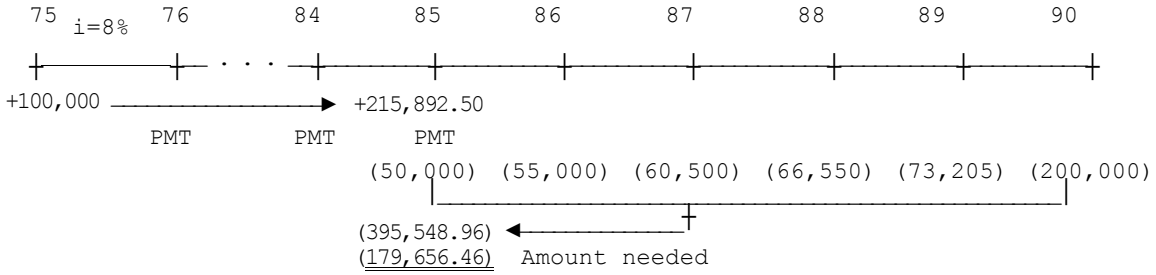
Step 3 The $100,000 now on hand will compound at 8% for 2 years:
$100,000(1.08)^2 = $116,640.

Step 4 The net funds needed is:

Need at t = 2	$ 128,659
Will have	(116,640)
Net needed	$ 12,019

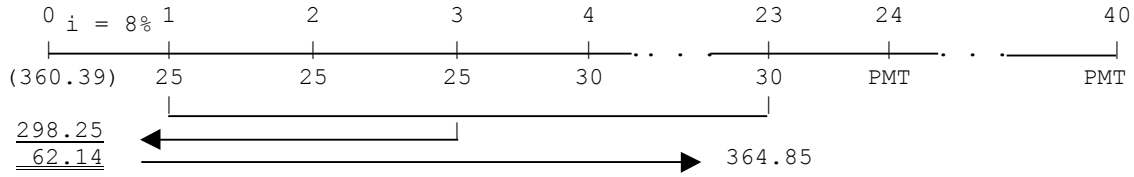
Step 5 Find the payments needed to accumulate $12,019. Set the calculator to "Begin" and then enter:
N = 2; I = 8; PV = 0; FV = 12,019. Solve for PMT = $5,350.

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



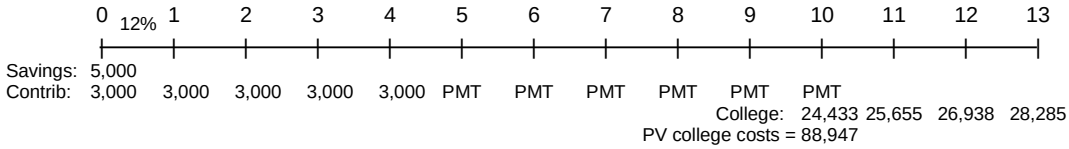
Value of cash outflows:
Age 85 CF_0 = ($ 50,000)
CF_1 = (55,000) = (-50,000)1.1
CF_2 = (60,500) = (-50,000)$(1.1)^2$
CF_3 = (66,550) = (-50,000)$(1.1)^3$
CF_4 = (73,205) = (-50,000)$(1.1)^4$
CF_5 = (200,000)
Solve for NPV at 8% = ($395,548.96).
Value of $100,000 at age 85: $100,000$(1.08)^{10}$ = $215,892.50.
Shortfall at age 85 = $215,892.50 - $395,548.96 = ($179,656.46).
Calculate annual payments to equal this shortfall:
N = 10; I/YR = 8; PV = 0; FV = 179,656.46.
Solve for PMT = $12,401.59.

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
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
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
Solve for PMT = $40.

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



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 solve for NPV = $88,947.

Step 3 Determine the value of their savings at t = 4 as follows:
N = 4, I = 12, PV = 8000, and PMT = 3000. 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, and FV = 88947. Solve for PMT = $4,411.

107. 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 solve for EFF% = 9.3807%.

Step 2 Compute the amount accumulated by age 40. Remember to change P/YR from 12 to 1. Set calculator to BEGIN mode. Then, enter N = 15, I = 9.3807, PV = 0, and PMT = 2000. 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, and PMT = 0. 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.) Set calculator to BEGIN mode. Then, enter PV = -110285.57, N = 26, I = 12, and FV = 0. Solve for PMT = $12,471.31 ≈ $12,471.

108. 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 = 20,101.43
CF_7 = 21,106.51
CF_8 = 44,323.66
CF_9 = 46,539.85
CF_{10} = 24,433.42
CF_{11} = 25,655.09
I = 12; 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 = 25,000
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 Mode
N = 12
I = 12
PV = -51,863.47
FV = 0
Solve for PMT = $7,475.60.

109. 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 the current date?

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). The present value as of the time she enters college, at 8%, is $129,983.70.

Now, what payments are needed every year until then?
N = 15
I = 8
PV = 10,000
FV = -129,983.70
Solve for PMT = $3,618.95.

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

Find the present value of the cost of college at t = 10. Use the cash flow register and remember that college costs increase each year by the rate of inflation.
t = 10: $CF_0 = \$35,000$.
t = 11: $CF_1 = \$35,000 \times 1.07 = \$37,450.00$.
t = 12: $CF_2 = \$35,000 \times (1.07)^2 = \$40,071.50$.
t = 13: $CF_3 = \$35,000 \times (1.07)^3 = \$42,876.51$.
I = 9; solve for NPV = $136,193.71.

Now figure out the amount of payments they should make:
N = 10
I = 9
PV = 20,000
FV = -136,193.71
PMT = $5,847.88 ≈ $5,848.

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

Step 1 Calculate the cost of tuition in each year:
t = 15: $25,000(1.05)^{15} = $51,973.20.
t = 16: $25,000(1.05)^{16} = $54,571.86 × 2 = $109,143.73.
t = 17: $25,000(1.05)^{17} = $57,300.46 × 2 = $114,600.92.
t = 18: $25,000(1.05)^{18} = $60,165.48 × 2 = $120,330.96.
t = 19: $25,000(1.05)^{19} = $63,173.75.

Step 2 Find the present value of these costs at t = 15:
CF_0 = 51,973.20
CF_1 = 109,143.73
CF_2 = 114,600.92
CF_3 = 120,330.96
CF_4 = 63,173.75
I = 12; 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 = 221,019.30
Solve for PMT = -$5,928.67.

112. 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.

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

We need to figure out how much money we would have saved if we didn't pay for the college costs.
N = 40
I = 10
PV = 0
PMT = -12,000
Solve for FV = $5,311,110.67.

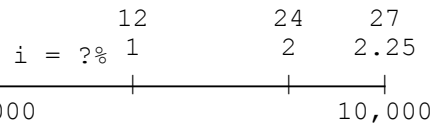
Now figure out how much we would use for college costs. First get the college costs at one point in time, t = 20 using the cash flow register.
CF_0 = 58,045
CF_1 = 62,108
CF_2 = 66,456 × 2 = 132,912 (two kids in school)
CF_3 = 71,108 × 2 = 142,216
CF_4 = 76,086
CF_5 = 81,411
I = 10; NPV = $433,718.02.

This is the value of the college costs at year t = 20. What we want is to know how much this is at t = 40
N = 20
I = 10
PV = -433,718.02
PMT = 0
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 ≈ $2,393,273.

114. 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*

$EAR_{Daily} = (1 + 0.080944/365)^{365} - 1 = 8.43\%$.

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 EAR_{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 = -8,000; PMT = 0; FV = 10,000.

Output: I = 10.4259 ≈ 10.43%.

Difference: 10.43% - 8.43% = 2.0%.

115. 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. On your financial calculator enter:
BEGIN mode (to indicate payments will be received at the start of the period)
N = 12
I = 12/12 = 1
PMT = -1,000
FV = 0
Solve for PV = $11,367.63.

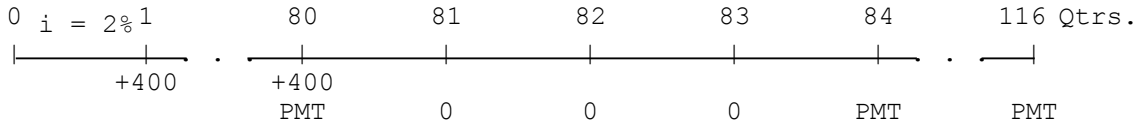
Option 2 can be valued as a lump sum payment to be received in the future. On your financial calculator enter:
END mode (to indicate the lump sum will be received at the end of the year)
N = 2
I = 12/2 = 6
PMT = 0
FV = 12,750
Solve for PV = $11,347.45.

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 x (1.20) = $ 960.00.
CF_3 = $ 960.00 x (1.20) = $1,152.00.
CF_4 = $1,152.00 x (1.20) = $1,382.40.
CF_5 = $1,382.40 x (1.20) = $1,658.88.
CF_6 = $1,658.88 x (1.20) = $1,990.66.
CF_7 = $1,990.66 x (1.20) = $2,388.79.
CF_8 = $2,388.79 x (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 CFj; 800 CFj; 960 CFj; 1,152 CFj; 1,382.40 CFj; 1,658.88 CFj; 1,990.66 CFj; 2,388.79 CFj; 2,866.54 CFj (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).

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



Find the FV at t = 80 of $400 quarterly payments:
N = 80; I = 2; PV = 0; and PMT = 400.
Solve for FV = $77,508.78.
Find the EAR of 8%, compounded quarterly, so you can determine the value of each of the receipts:

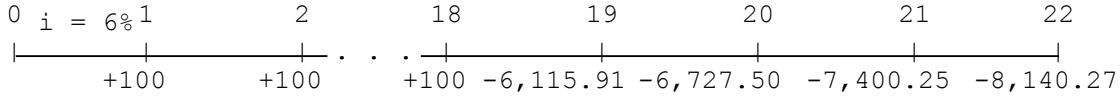
$$EAR = \left(1 + \frac{0.08}{4}\right)^4 - 1 = 8.2432\%.$$

Now, determine the value of each of the receipts, remembering that this is an annuity due. With a financial calculator input the following:
N = 10; I = 8.2432; PV = -77,508.78; and FV = 0.
Solve for PMT = $10,788.78 ≈ $10,789.

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

Parent's savings:
N = 18
I = 6
PMT = 100
FV = 0
Solve for PV = $1,082.76.

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



-$8,554.84 PV of Health care costs
1,082.76 PV of parents' savings
-$7,472.08 Lump sum government must set aside

$CF_0 = 0$
$CF_{1-18} = 0$
$CF_{19} = -6,115.91$
$CF_{20} = -6,727.50$
$CF_{21} = -7,400.25$
$CF_{22} = -8,140.27$
I = 6
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.
Alternatively,
$CF_0 = 0$
$CF_{1-18} = 100$
$CF_{19} = -6,115.91$
$CF_{20} = -6,727.50$
$CF_{21} = -7,400.25$
$CF_{22} = -8,140.27$
I = 6
Solve for NPV = -$7,472.08 = Lump sum government must set aside now.

2E-118. PV continuous compounding **Answer: b Diff: E**

$PV = FV_n/e^{in} = \$100,000/e^{0.09(6)} = \$100,000/1.7160 = \$58,275.$

2E-119. FV continuous compounding **Answer: a Diff: M**

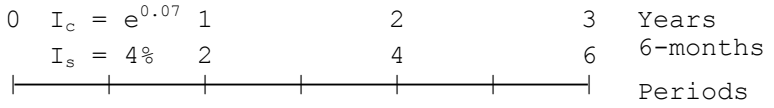
Daily compounding:
$FV_2 = PV\ (1 + 0.06/365)^{365(2)} = \$1,000\ (1.12749) = \$1,127.49$
Continuous compounding:
$FV_2 = PV\ e^{in} = \$1,000\ (e^{0.059(2)}) = \$1,000(1.12524) = \$1,125.24$
Difference between accounts $2.25

2E-120. Continuous compounded interest rate **Answer: a Diff: M**

Calculate the growth factor using PV and FV which are given:
$FV_n = PV\ e^{in}$; $\$19,000 = \$14,014\ e^{i4}$
$e^{i4} = 1.35579.$

Financial calculator solution:
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 = 0.3044.
i(4) = 0.3044
i = 0.0761 = 7.61%.

2E-121. Payment and continuous compounding **Answer: d Diff: M**



Account with continuous compounding: -1,000 → $FV_c = ? = 1,233.70$

Account with semiannual compounding: $PV_s = ?$ → $FV_s = ? = 1,233.70$

Financial calculator solution:
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 = 1,233.70.
Output: PV = $975.01.

2E-122. Continuous compounding **Answer: a Diff: M**

Determine the effective annual rates.
a) 12.5% annually = 12.5%.

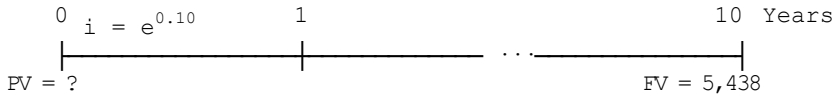
Financial calculator solution:
Use interest rate conversion feature or e^X exponential key on some calculators. Calculate EAR with continuous compounding.
b) Inputs: P/YR = 2; NOM% = 12. Output: EFF% = EAR = 12.36%.

b) 12.0% semiannually = $\left(1 + \frac{0.12}{2}\right)^2 - 1.0 = 0.1236 = 12.36\%$.

c) Inputs: Continuous compounding CONT; NOM% = 11.5.
Output: EFF% = EAR = 12.187% ≈ 12.19%.
c) 11.5% continuously = $e^{0.115} - 1.0 = 0.1219 = 12.19\%$.

2E-123. Continuous compounding **Answer: b Diff: M**

Time line:



Numerical solution:
(Constant e = 2.7183 rounded.)
$\$5{,}438 = PVe^{0.10(10)} = PVe^{1.0}$
$PV = \$5{,}438/e$
$= \$5{,}438/2.7183 = \$2{,}000.52 \approx \$2{,}000.$

Financial calculator solution:
Use interest rate conversion feature or e^X exponential key on some calculators. Calculate EAR with continuous compounding.
Inputs: Continuous compounding CONT; NOM% = 10.
Output: EFF% = EAR = 10.52%.
Using e^x key:
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 = 5,438.
Output: PV = -$2,000.

2E-124. Continuous compounding **Answer: d Diff: M**

Numerical solution:

$$e^{(0.04)(10)} = \left(1 + \frac{i}{2}\right)^{20}$$

$$e^{0.4} = \left(1 + \frac{i}{2}\right)^{20}$$

$$e^{0.02} = 1 + \frac{i}{2}$$

$$1.0202 = 1 + \frac{i}{2}$$

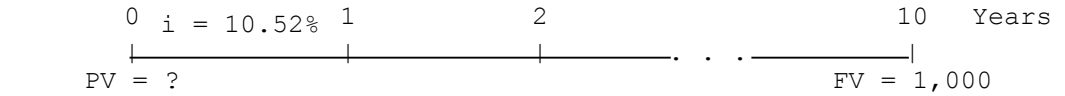
$$\frac{i}{2} = 0.0202$$

$$i = 0.0404 = 4.04\%.$$

Financial calculator solution:
Use interest rate conversion feature or e^x exponential key on some calculators. Calculate EAR with continuous compounding.
Inputs: Continuous compounding: CONT; NOM% = 4.
Output: EFF% = EAR = 4.08%.
Calculate the nominal annual rate from the effective rate using continuous compounding:
Inputs: Semiannual compounding: P/YR = 2; EFF% = EAR = 4.08.
Output: NOM% = 4.04%.

2E-125. Continuous compounding **Answer: b Diff: M**

Time Line:

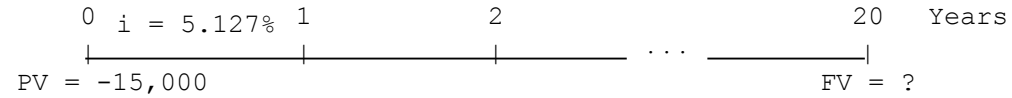


Numerical solution:
$\$1,000 = PVe^{0.10(10)} = PVe^{1.0}$
PV = \$1,000/e = \$1,000/2.7183 = \$367.88 ≈ \$368.

Financial calculator solution:
Use interest rate conversion feature or e^x exponential key on some calculators. Calculate EAR with continuous compounding.
Inputs: Continuous compounding: CONT; NOM% = 10
Output: EFF% = EAR = 10.52%.
Using e^x key:
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 = 1,000.
Output: PV = -\$367.78 ≈ \$368.

2E-126. 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.)
Calculate the EAR of 5% compounded continuously
Inputs: Continuous compounding CONT; NOM% = 5.
Output: EFF% = EAR = 5.127%.
Using e^x key:
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 = -15,000; PMT = 0.
Output: FV = \$40,773.38 ≈ \$40,774.