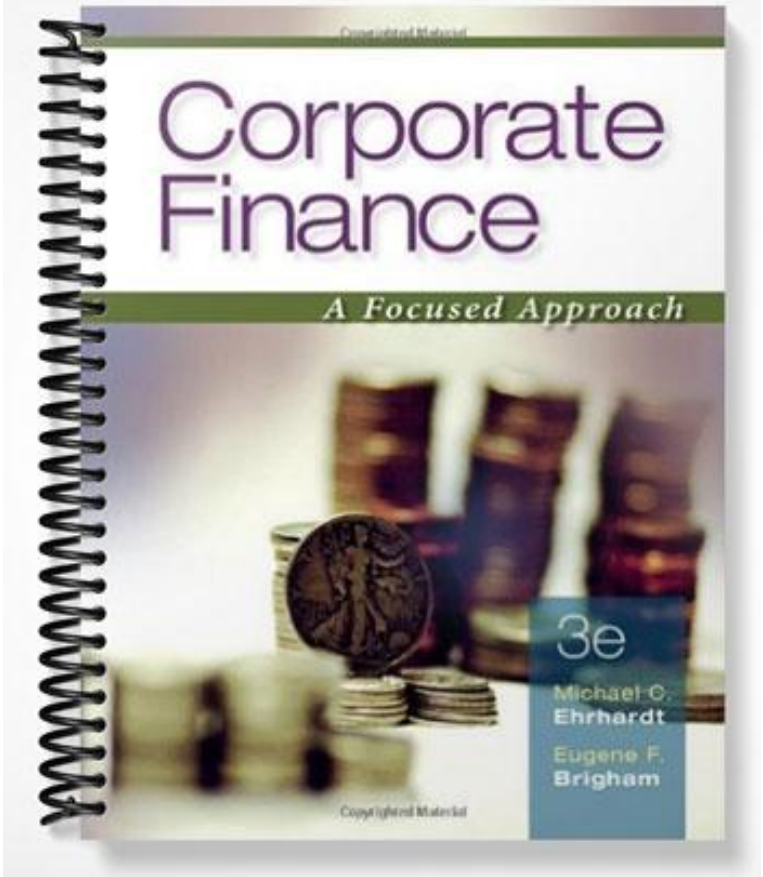
TEST BANK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CHAPTER 2
TIME VALUE OF MONEY

True/False

Easy:

(2.2) Compounding **Answer: a EASY**

1. One potential benefit from starting to invest early for retirement is that the investor can expect greater benefits from the compounding of interest.

   a. True
   b. False

(2.3) PV versus FV **Answer: b EASY**

2. 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

(2.3) PV versus FV **Answer: a EASY**

3. Disregarding risk, if money has time value, it is impossible for the present value of a given sum to exceed its future value.

   a. True
   b. False

(2.15) Effective annual rate **Answer: b EASY**

4. If a bank compounds savings accounts quarterly, the nominal rate will exceed the effective annual rate.

   a. True
   b. False

(2.17) Amortization **Answer: a EASY**

5. The payment made each period on an amortized loan is constant, and it consists of some interest and some principal. The closer we are to the end of the loan's life, the greater the percentage of the payment that will be a repayment of principal.

   a. True
   b. False

Medium:

(2.2) Compounding **Answer: b MEDIUM**

6. The greater the number of compounding periods within a year, then (1) the greater the future value of a lump sum investment at Time 0 and (2) the greater the present value of a given lump sum to be received at some future date.

a. True
b. False

(2.2) Comparative compounding **Answer: a MEDIUM**

7. Suppose an investor plans to invest a given sum of money. She can earn an effective annual rate of 5% on Security A, while Security B will provide an effective annual rate of 12%. Within 11 years' time, the compounded value of Security B will be more than twice the compounded value of Security A. (Ignore risk, and assume that compounding occurs annually.)

a. True
b. False

(2.3) PV of a sum **Answer: a MEDIUM**

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

a. True
b. False

(2.9) PV of an annuity **Answer: a MEDIUM**

9. 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

(2.15) Effective and nominal rates **Answer: a MEDIUM**

10. As a result of compounding, the effective annual rate on a bank deposit (or a loan) is always equal to or greater than the nominal rate on the deposit (or loan).

a. True
b. False

(2.15) Periodic and nominal rates **Answer: a MEDIUM**

11. If we are given a periodic interest rate, say a monthly rate, we can find the nominal annual rate by multiplying the periodic rate by the number of periods per year.

a. True
b. False

(2.17) Amortization **Answer: b MEDIUM**

12. When a loan is amortized, a relatively high percentage of the payment goes to reduce the outstanding principal in the early years, and the principal repayment's percentage declines in the loan's later years.

a. True
b. False

(2.17) Amortization **Answer: b MEDIUM**

13. Midway through the life of an amortized loan, the percentage of the payment that represents interest is equal to the percentage that represents principal repayment. This is true regardless of the original life of the loan.

a. True
b. False

Multiple Choice: Conceptual

Easy:

(2.1) Time lines **Answer: a EASY**

14. Which of the following statements is **NOT** CORRECT?

a. A time line is meaningful only if all cash flows occur annually.
b. Time lines are useful for visualizing complex problems prior to doing actual calculations.
c. Time lines can be constructed even in situations where some of the cash flows occur annually but others occur quarterly.
d. Time lines can be constructed for annuities where the payments occur at either the beginning or the end of periods.
e. The cash flows shown on a time line can be in the form of annuity payments, but they can also be uneven amounts.

(2.1) Time lines **Answer: b EASY**

15. Which of the following statements is CORRECT?

a. A time line is not meaningful unless all cash flows occur annually.
b. Time lines are useful for visualizing complex problems prior to doing actual calculations.
c. Time lines cannot be constructed to deal with situations where some of the cash flows occur annually but others occur quarterly.
d. Time lines can only be constructed for annuities where the payments occur at the ends of the periods, i.e., for ordinary annuities.
e. Time lines cannot be constructed where some of the payments constitute an annuity but others are unequal and thus are not part of the annuity.

(2.3) Effects of factors on PVs **Answer: b EASY**

16. You are analyzing the value of a potential investment by calculating the sum of the present values of its expected cash flows. Which of the following would lower the calculated value of the investment?

    a. The cash flows are in the form of a deferred annuity, and they total to $100,000. You learn that the annuity lasts for only 5 rather than 10 years, hence that each payment is for $20,000 rather than for $10,000.
    b. The discount rate increases.
    c. The riskiness of the investment's cash flows decreases.
    d. The total amount of cash flows remains the same, but more of the cash flows are received in the earlier years and less are received in the later years.
    e. The discount rate decreases.

(2.6) Annuities **Answer: d EASY**

17. Which of the following statements is CORRECT?

    a. The cash flows for an ordinary (or deferred) annuity all occur at the beginning of the periods.
    b. If a series of unequal cash flows occurs at regular intervals, such as once a year, then the series is by definition an annuity.
    c. The cash flows for an annuity due must all occur at the ends of the periods.
    d. The cash flows for an annuity must all be equal, and they must occur at regular intervals, such as once a year or once a month.
    e. If some cash flows occur at the beginning of the periods while others occur at the ends, then we have what the textbook defines as a variable annuity.

Medium:

(2.14) Solving for I with uneven cash flows **Answer: c MEDIUM**

18. Which of the following statements is CORRECT?

    a. If you have a series of cash flows, all of which are positive, you can solve for I, where the solution value of I causes the PV of the cash flows to equal the cash flow at Time 0.
    b. If you have a series of cash flows, and CF_0 is negative but all of the other CFs are positive, you can solve for I, but only if the sum of the undiscounted cash flows exceeds the cost.
    c. To solve for I, one must identify the value of I that causes the PV of the positive CFs to equal the absolute value of the PV of the negative CFs. This is, essentially, a trial-and-error procedure that is easy with a computer or financial calculator but quite difficult otherwise.
    d. If you solve for I and get a negative number, then you must have made a mistake.
    e. If CF_0 is positive and all the other CFs are negative, then you cannot solve for I.

(2.15) Effective annual rate **Answer: e MEDIUM**

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

a. An account that pays 8% nominal interest with monthly compounding.
b. An account that pays 8% nominal interest with annual compounding.
c. An account that pays 7% nominal interest with daily (365-day) compounding.
d. An account that pays 7% nominal interest with monthly compounding.
e. An account that pays 8% nominal interest with daily (365-day) compounding.

(2.15) Quarterly compounding **Answer: c MEDIUM**

20. Your bank account pays a 6% nominal rate of interest. The interest is compounded quarterly. Which of the following statements is CORRECT?

a. The periodic rate of interest is 1.5% and the effective rate of interest is 3%.
b. The periodic rate of interest is 6% and the effective rate of interest is greater than 6%.
c. The periodic rate of interest is 1.5% and the effective rate of interest is greater than 6%.
d. The periodic rate of interest is 3% and the effective rate of interest is 6%.
e. The periodic rate of interest is 6% and the effective rate of interest is also 6%.

(2.17) Amortization **Answer: c MEDIUM**

21. A $50,000 loan is to be amortized over 7 years, with annual end-of-year payments. Which of these statements is 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 7 years, and if the interest rate were the same in either case, the first payment would include more dollars of interest under the 7-year amortization plan.
c. The proportion of each payment that represents interest as opposed to repayment of principal would be lower if the interest rate were lower.
d. The last payment would have a higher proportion of interest than the first payment.
e. The proportion of interest versus principal repayment would be the same for each of the 7 payments.

(2.17) Amortization **Answer: a MEDIUM**

22. Which of the following statements regarding a 15-year (180-month) $125,000 fixed-rate mortgage is **NOT** CORRECT? (Ignore all taxes and transactions costs.)

a. The remaining balance after three years will be $125,000 less the total amount of interest paid during the first 36 months.
b. Because it is a fixed-rate mortgage, the monthly loan payments (that include both interest and principal payments) are constant.
c. Interest payments on the mortgage will steadily decline over time.
d. The proportion of the monthly payment that goes towards repayment of principal will be higher 10 years from now than it will be the first year.
e. The outstanding balance gets paid off at a faster rate in the later years of a loan's life.

(2.17) Amortization **Answer: b MEDIUM**

23. Which of the following statements regarding a 30-year monthly payment amortized mortgage with a nominal interest rate of 10% is CORRECT?

a. The monthly payments will decline over time.
b. A smaller proportion of the last monthly payment will be interest, and a larger proportion will be principal, than for the first monthly payment.
c. The total dollar amount of principal being paid off each month gets smaller as the loan approaches maturity.
d. The amount representing interest in the first payment would be higher if the nominal interest rate were 7% rather than 10%.
e. Exactly 10% of the first monthly payment represents interest.

(Comp: 2.2,2.7,2.8) Time value concepts **Answer: a MEDIUM**

24. Which of the following investments will have the highest future value at the end of 10 years? Assume that the effective annual rate for all investments is the same.

a. Investment A pays $250 at the beginning of every year for the next 10 years (a total of 10 payments).
b. Investment B pays $125 at the end of every 6-month period for the next 10 years (a total of 20 payments).
c. Investment C pays $125 at the beginning of every 6-month period for the next 10 years (a total of 20 payments).
d. Investment D pays $2,500 at the end of 10 years (a total of one payment).
e. Investment E pays $250 at the end of every year for the next 10 years (a total of 10 payments).

(Comp: 2.3,2.9,2.15) Various concepts **Answer: d MEDIUM**

25. A Treasury bond promises to pay a lump sum of $1,000 exactly 3 years from today. The nominal interest rate is 6%, semiannual compounding. Which of the following statements is CORRECT?

    a. The periodic interest rate is greater than 3%.
    b. The periodic rate is less than 3%.
    c. The present value would be greater if the lump sum were discounted back for more periods.
    d. The present value of the $1,000 would be smaller if interest were compounded monthly rather than semiannually.
    e. The PV of the $1,000 lump sum has a higher present value than the PV of a 3-year, $333.33 ordinary annuity.

(Comp: 2.2,2.9,2.15,2.17) Various concepts **Answer: c MEDIUM**

26. Which of the following statements is CORRECT, assuming positive interest rates and other things held constant?

    a. A 5-year, $250 annuity due will have a lower present value than a similar ordinary annuity.
    b. A 30-year, $150,000 amortized mortgage will have larger monthly payments than an otherwise similar 20-year mortgage.
    c. A typical investment's nominal interest rate will always be equal to or less than its effective annual rate.
    d. If an investment pays 10% interest, compounded annually, its effective annual rate will be less than 10%.
    e. Banks A and B offer the same nominal annual rate of interest, but A pays interest quarterly and B pays semiannually. Deposits in Bank B will have the higher future value if you leave the funds on deposit.

(Comp: 2.9,2.15,2.17) Various concepts **Answer: e MEDIUM**

27. Which of the following statements is **NOT** CORRECT?

    a. The present value of a 3-year, $150 annuity due will exceed the present value of a 3-year, $150 ordinary annuity.
    b. If a loan has a nominal annual rate of 8%, then the effective rate can never be less than 8%.
    c. If a loan or investment has annual payments, then the effective, periodic, and nominal rates of interest will all be the same.
    d. The proportion of the payment that goes toward interest on a fully amortized loan declines over time.
    e. An investment that has a nominal rate of 6% with semiannual payments will have an effective rate that is less than 6%.

(Comp: 2.7,2.8,2.9) Annuities **Answer: d MEDIUM**

28. You are considering two equally risky annuities, each of which pays $5,000 per year for 10 years. Investment ORD is an ordinary (or deferred) annuity, while Investment DUE is an annuity due. Which of the following statements is CORRECT?

    a. The present value of ORD must exceed the present value of DUE, but the future value of ORD may be less than the future value of DUE.
    b. The present value of DUE exceeds the present value of ORD, while the future value of DUE is less than the future value of ORD.
    c. The present value of ORD exceeds the present value of DUE, and the future value of ORD also exceeds the future value of DUE.
    d. The present value of DUE exceeds the present value of ORD, and the future value of DUE also exceeds the future value of ORD.
    e. If the going rate of interest decreases, say from 10% to 0%, the difference between the present value of ORD and the present value of DUE would remain constant.

Hard:

(2.15) Effective annual rates **Answer: e HARD**

29. You plan to invest some money in a bank account. Which of the following banks provides you with the highest effective rate of interest?

    a. Bank 1; 6.1% with annual compounding.
    b. Bank 2; 6.0% with monthly compounding.
    c. Bank 3; 6.0% with annual compounding.
    d. Bank 4; 6.0% with quarterly compounding.
    e. Bank 5; 6.0% with daily (365-day) compounding.

Multiple Choice: Problems

Easy:

(2.2) FV of a lump sum **Answer: d EASY**

30. What would the future value of $125 be after 8 years at 8.5% compound interest?

    a. $205.83
    b. $216.67
    c. $228.07
    d. $240.08
    e. $252.08

(2.2) FV of a lump sum **Answer: a EASY**

31. Suppose you have $1,500 and plan to purchase a 5-year certificate of deposit (CD) that pays 3.5% interest, compounded annually. How much will you have when the CD matures?

a. $1,781.53
b. $1,870.61
c. $1,964.14
d. $2,062.34
e. $2,165.46

(2.2) FV of a lump sum **Answer: c EASY**

32. Last year Toto Corporation's sales were $225 million. If sales grow at 6% per year, how large (in millions) will they be 5 years later?

a. $271.74
b. $286.05
c. $301.10
d. $316.16
e. $331.96

(2.2) FV of a lump sum **Answer: b EASY**

33. How much would $1, growing at 3.5% per year, be worth after 75 years?

a. $12.54
b. $13.20
c. $13.86
d. $14.55
e. $15.28

(2.2) FV of a lump sum **Answer: b EASY**

34. You deposit $1,000 today in a savings account that pays 3.5% interest, compounded annually. How much will your account be worth at the end of 25 years?

a. $2,245.08
b. $2,363.24
c. $2,481.41
d. $2,605.48
e. $2,735.75

(2.3) PV of a lump sum **Answer: a EASY**

35. Suppose a U.S. government bond promises to pay $1,000 five years from now. If the going interest rate on 5-year government bonds is 5.5%, how much is the bond worth today?

a. $765.13
b. $803.39
c. $843.56
d. $885.74
e. $930.03

(2.3) PV of a lump sum **Answer: e EASY**

36. How much would $5,000 due in 50 years be worth today if the discount rate were 7.5%?

a. $109.51
b. $115.27
c. $121.34
d. $127.72
e. $134.45

(2.3) PV of a lump sum **Answer: b EASY**

37. Suppose a U.S. treasury bond will pay $2,500 five years from now. If the going interest rate on 5-year treasury bonds is 4.25%, how much is the bond worth today?

a. $1,928.78
b. $2,030.30
c. $2,131.81
d. $2,238.40
e. $2,350.32

(2.4) Interest rate on a lump sum **Answer: d EASY**

38. Suppose the U.S. Treasury offers to sell you a bond for $747.25. No payments will be made until the bond matures 5 years from now, at which time it will be redeemed for $1,000. What interest rate would you earn if you bought this bond at the offer price?

a. 4.37%
b. 4.86%
c. 5.40%
d. 6.00%
e. 6.60%

(2.4) Growth rate **Answer: b EASY**

39. Ten years ago, Levin Inc. earned $0.50 per share. Its earnings this year were $2.20. What was the growth rate in Levin's earnings per share (EPS) over the 10-year period?

a. 15.17%
b. 15.97%
c. 16.77%
d. 17.61%
e. 18.49%

(2.5) Number of periods **Answer: e EASY**

40. How many years would it take $50 to triple if it were invested in a bank that pays 3.8% per year?

a. 23.99
b. 25.26
c. 26.58
d. 27.98
e. 29.46

(2.5) Number of periods **Answer: d EASY**

41. Last year Mason Corp's earnings per share were $2.50, and its growth rate during the prior 5 years was 9.0% per year. If that growth rate were maintained, how many years would it take for Mason's EPS to double?

a. 5.86
b. 6.52
c. 7.24
d. 8.04
e. 8.85

(2.5) Number of periods **Answer: e EASY**

42. You plan to invest in securities that pay 9.0%, compounded annually. If you invest $5,000 today, how many years will it take for your investment account to grow to $9,140.20?

a. 4.59
b. 5.10
c. 5.67
d. 6.30
e. 7.00

(2.7) FV of an ordinary annuity **Answer: c EASY**

43. You want to buy a new sports car 3 years from now, and you plan to save $4,200 per year, beginning one year from today. You will deposit your savings in an account that pays 5.2% interest. How much will you have just after you make the 3rd deposit, 3 years from now?

a. $11,973.07
b. $12,603.23
c. $13,266.56
d. $13,929.88
e. $14,626.38

(2.7) FV of an ordinary annuity **Answer: a EASY**

44. You want to go to Europe 5 years from now, and you can save $3,100 per year, beginning one year from today. You plan to deposit the funds in a mutual fund which you expect to return 8.5% per year. Under these conditions, how much will you have just after you make the 5th deposit, 5 years from now?

a. $18,368.66
b. $19,287.09
c. $20,251.44
d. $21,264.02
e. $22,327.22

(2.8) FV of an annuity due **Answer: a EASY**

45. You want to buy a new sports car 3 years from now, and you plan to save $4,200 per year, beginning immediately. You will make 3 deposits in an account that pays 5.2% interest. Under these assumptions, how much will you have 3 years from today?

a. $13,956.42
b. $14,654.24
c. $15,386.95
d. $16,156.30
e. $16,964.11

(2.8) FV of an annuity due **Answer: c EASY**

46. You want to go to Europe 5 years from now, and you can save $3,100 per year, beginning immediately. You plan to deposit the funds in a mutual fund which you expect to return 8.5% per year. Under these conditions, how much will you have just after you make the 5th deposit, 5 years from now?

a. $17,986.82
b. $18,933.49
c. $19,929.99
d. $20,926.49
e. $21,972.82

(2.9) PV of an ordinary annuity **Answer: e EASY**

47. What is the PV of an ordinary annuity with 10 payments of $2,700 if the appropriate interest rate is 6.5%?

a. $15,809.44
b. $16,641.51
c. $17,517.38
d. $18,439.35
e. $19,409.84

(2.9) PV of an ordinary annuity **Answer: e EASY**

48. You have a chance to buy an annuity that pays $1,200 at the end of each year for 3 years. You could earn 5.5% on your money in other investments with equal risk. What is the most you should pay for the annuity?

a. $2,636.98
b. $2,775.77
c. $2,921.86
d. $3,075.64
e. $3,237.52

(2.9) PV of an ordinary annuity **Answer: b EASY**

49. Your aunt is about to retire, and she wants to buy an annuity that will supplement her income by $65,000 per year for 25 years, beginning a year from today. The going rate on such annuities is 6.25%. How much would it cost her to buy such an annuity today?

a. $770,963.15
b. $811,540.16
c. $852,117.17
d. $894,723.02
e. $939,459.18

(2.9) PV of an annuity due **Answer: a EASY**

50. What is the PV of an annuity due with 10 payments of $2,700 at an interest rate of 6.5%?

a. $20,671.48
b. $21,705.06
c. $22,790.31
d. $23,929.82
e. $25,126.31

(2.9) PV of an annuity due **Answer: c EASY**

51. You have a chance to buy an annuity that pays $550 at the beginning of each year for 3 years. You could earn 5.5% on your money in other investments with equal risk. What is the most you should pay for the annuity?

a. $1,412.84
b. $1,487.20
c. $1,565.48
d. $1,643.75
e. $1,725.94

(2.9) PV of an annuity due **Answer: d EASY**

52. Your aunt is about to retire, and she wants to buy an annuity that will provide her with $65,000 of income a year for 25 years, with the first payment coming immediately. The going rate on such annuities is 6.25%. How much would it cost her to buy the annuity today?

a. $739,281.38
b. $778,190.93
c. $819,148.35
d. $862,261.42
e. $905,374.49

(2.9) PV of an annuity due **Answer: b EASY**

53. You own an oil well that will pay you $30,000 per year for 10 years, with the first payment being made today. If you think a fair return on the well is 8.5%, how much should you ask for if you decide to sell it?

a. $202,893
b. $213,572
c. $224,250
d. $235,463
e. $247,236

(2.9) PV of an ordinary annuity plus an ending payment **Answer: e EASY**

54. What's the present value of a 4-year ordinary annuity of $2,250 per year plus an additional $3,000 at the end of Year 4 if the interest rate is 5%?

a. $8,508.74
b. $8,956.56
c. $9,427.96
d. $9,924.17
e. $10,446.50

(2.10) Payments on an ordinary annuity **Answer: a EASY**

55. Suppose you inherited $275,000 and invested it at 8.25% per year. How much could you withdraw at the end of each of the next 20 years?

a. $28,532.45
b. $29,959.08
c. $31,457.03
d. $33,029.88
e. $34,681.37

(2.10) Payments on an ordinary annuity **Answer: d EASY**

56. Your uncle has $375,000 and wants to retire. He expects to live for another 25 years, and to be able to earn 7.5% on his invested funds. How much could he withdraw at the end of each of the next 25 years and end up with zero in the account?

a. $28,843.38
b. $30,361.46
c. $31,959.43
d. $33,641.50
e. $35,323.58

(2.10) Payments on an annuity due **Answer: c EASY**

57. Your uncle has $375,000 and wants to retire. He expects to live for another 25 years, and he also expects to earn 7.5% on his invested funds. How much could he withdraw at the beginning of each of the next 25 years and end up with zero in the account?

a. $28,243.21
b. $29,729.70
c. $31,294.42
d. $32,859.14
e. $34,502.10

(2.10) Payments on an annuity due **Answer: d EASY**

58. Suppose you inherited $275,000 and invested it at 8.25% per year. How much could you withdraw at the beginning of each of the next 20 years?

a. $22,598.63
b. $23,788.03
c. $25,040.03
d. $26,357.92
e. $27,675.82

(2.10) Years to deplete an ordinary annuity **Answer: a EASY**

59. Your uncle has $375,000 invested at 7.5%, and he now wants to retire. He wants to withdraw $35,000 at the end of each year, beginning at the end of this year. How many years will it take to exhaust his funds, i.e., run the account down to zero?

a. 22.50
b. 23.63
c. 24.81
d. 26.05
e. 27.35

(2.10) Years to deplete an annuity due **Answer: e EASY**

60. Your uncle has $500,000 invested at 7.5%, and he now wants to retire. He wants to withdraw $40,000 at the beginning of each year, beginning immediately. How many years will it take to exhaust his funds, i.e., run the account down to zero?

a. 23.16
b. 24.38
c. 25.66
d. 27.01
e. 28.44

(2.10) Interest rate implicit in an annuity **Answer: b EASY**

61. You just won the state lottery, and you have a choice between receiving $3,500,000 today or a 10-year annuity of $500,000, with the first payment coming one year from today. What rate of return is built into the annuity?

a. 6.72%
b. 7.07%
c. 7.43%
d. 7.80%
e. 8.19%

(2.10) Interest rate implicit in an annuity **Answer: c EASY**

62. Your girlfriend just won the Florida lottery. She has the choice of $15,000,000 today or a 20-year annuity of $1,050,000, with the first payment coming one year from today. What rate of return is built into the annuity?

a. 2.79%
b. 3.10%
c. 3.44%
d. 3.79%
e. 4.17%

(2.10) Interest rate implicit in an annuity due **Answer: e EASY**

63. Assume that you own an annuity that will pay you $15,000 per year for 12 years, with the first payment being made today. Your uncle offers to give you $120,000 for the annuity. If you sell it, what rate of return would your uncle earn on his investment?

a. 6.85%
b. 7.21%
c. 7.59%
d. 7.99%
e. 8.41%

(2.11) PV of a perpetuity **Answer: b EASY**

64. What's the present value of a perpetuity that pays $250 per year if the appropriate interest rate is 5%?

a. $4,750.00
b. $5,000.00
c. $5,250.00
d. $5,512.50
e. $5,788.13

(2.11) Rate of return on a perpetuity **Answer: d EASY**

65. What's the rate of return you would earn if you paid $950 for a perpetuity that pays $85 per year?

a. 6.52%
b. 7.25%
c. 8.05%
d. 8.95%
e. 9.84%

(2.12) PV of an uneven cash flow stream **Answer: e EASY**

66. At a rate of 6.25%, what is the present value of the following cash flow stream? $0 at Time 0; $75 at the end of Year 1; $225 at the end of Year 2; $0 at the end of Year 3; and $300 at the end of Year 4?

a. $411.57
b. $433.23
c. $456.03
d. $480.03
e. $505.30

(2.12) PV of an uneven cash flow stream **Answer: c EASY**

67. What is the present value of the following cash flow stream at an interest rate of 12.0% per year? $0 at Time 0; $1,500 at the end of Year 1; $3,000 at the end of Year 2; $4,500 at the end of Year 3; and $6,000 at the end of Year 4.

a. $9,699.16
b. $10,209.64
c. $10,746.99
d. $11,284.34
e. $11,848.55

Easy/Medium:

(2.12) PV of an uneven cash flow stream Answer: d EASY/MEDIUM

68. An investment promises the following cash flow stream: $750 at Time 0; $2,450 at the end of Year 1 (or at t = 1); $3,175 at the end of Year 2; and $4,400 at the end of Year 3. At a discount rate of 8.0%, what is the present value of the cash flow stream?

a. $7,916.51
b. $8,333.17
c. $8,771.76
d. $9,233.43
e. $9,695.10

(2.12) PV of an uneven cash flow stream Answer: a EASY/MEDIUM

69. What is the present value of the following cash flow stream if the interest rate is 6.0% per year? 0 at Time 0; $1,000 at the end of Year 1; and $2,000 at the end of Years 2, 3, and 4.

a. $5,986.81
b. $6,286.16
c. $6,600.46
d. $6,930.49
e. $7,277.01

(2.15) FV of a lump sum, semiannual compounding Answer: c EASY/MEDIUM

70. What's the future value of $1,500 after 5 years if the appropriate interest rate is 6%, compounded semiannually?

a. $1,819.33
b. $1,915.08
c. $2,015.87
d. $2,116.67
e. $2,222.50

(2.15) PV of a lump sum, semiannual compounding Answer: d EASY/MEDIUM

71. What's the present value of $1,500 discounted back 5 years if the appropriate interest rate is 6%, compounded semiannually?

a. $956.95
b. $1,007.32
c. $1,060.33
d. $1,116.14
e. $1,171.95

Medium:

(2.10) Years to deplete an ordinary annuity **Answer: b MEDIUM**

72. Your uncle has $300,000 invested at 7.5%, and he now wants to retire. He wants to withdraw $35,000 at the end of each year, beginning at the end of this year. He also wants to have $25,000 left to give you when he ceases to withdraw funds from the account. For how many years can he make the $35,000 withdrawals and still have $25,000 left in the end?

a. 14.21
b. 14.96
c. 15.71
d. 16.49
e. 17.32

(2.10) Years to deplete an annuity due **Answer: c MEDIUM**

73. Your uncle has $300,000 invested at 7.5%, and he now wants to retire. He wants to withdraw $35,000 at the beginning of each year, beginning immediately. He also wants to have $25,000 left to give you when he ceases to withdraw funds from the account. For how many years can he make the $35,000 withdrawals and still have $25,000 left in the end?

a. 11.98
b. 12.61
c. 13.27
d. 13.94
e. 14.63

(2.10) Interest rate implicit in an annuity due **Answer: a MEDIUM**

74. You agree to make 24 deposits of $500 at the beginning of each month into a bank account. At the end of the 24th month, you will have $13,000 in your account. If the bank compounds interest monthly, what nominal annual interest rate will you be earning?

a. 7.62%
b. 8.00%
c. 8.40%
d. 8.82%
e. 9.26%

(2.11) Payments on a perpetuity **Answer: b MEDIUM**

75. What annual payment would you have to receive in order to earn a 7.5% rate of return on a perpetuity that has a cost of $1,250?

a. $89.06
b. $93.75
c. $98.44
d. $103.36
e. $108.53

(2.13) FV of an uneven cash flow stream **Answer: e MEDIUM**

76. At a rate of 6.5%, what is the future value of the following cash flow stream? $0 at Time 0; $75 at the end of Year 1; $225 at the end of Year 2; $0 at the end of Year 3; and $300 at the end of Year 4?

a. $526.01
b. $553.69
c. $582.83
d. $613.51
e. $645.80

(2.14) Interest rate built into uneven CF stream **Answer: c MEDIUM**

77. An investment costs $1,000 (CF at t = 0) and is expected to produce cash flows of $75 at the end of each of the next 5 years, then an additional lump sum payment of $1,000 at the end of the 5th year. What is the expected rate of return on this investment?

a. 6.77%
b. 7.13%
c. 7.50%
d. 7.88%
e. 8.27%

(2.14) Interest rate built into uneven CF stream **Answer: e MEDIUM**

78. An investment costs $725 and is expected to produce cash flows of $75 at the end of Year 1, $100 at the end of Year 2, $85 at the end of Year 3, and $625 at the end of Year 4. What rate of return would you earn if you bought this investment?

a. 4.93%
b. 5.19%
c. 5.46%
d. 5.75%
e. 6.05%

(2.15) FV of a lump sum, monthly compounding **Answer: b MEDIUM**

79. What's the future value of $1,500 after 5 years if the appropriate interest rate is 6%, compounded monthly?

a. $1,922.11
b. $2,023.28
c. $2,124.44
d. $2,230.66
e. $2,342.19

(2.15) PV of a lump sum, monthly compounding **Answer: d MEDIUM**

80. What's the present value of $1,525 discounted back 5 years if the appropriate interest rate is 6%, compounded monthly?

a. $969.34
b. $1,020.36
c. $1,074.06
d. $1,130.59
e. $1,187.12

(2.15) APR vs. EAR **Answer: b MEDIUM**

81. Credit card issuers must by law print the Annual Percentage Rate (APR) on their monthly statements. If the APR is stated to be 18.00%, with interest paid monthly, what is the card's EFF%?

a. 18.58%
b. 19.56%
c. 20.54%
d. 21.57%
e. 22.65%

(2.15) Comparing the effective cost of two bank loans **Answer: d MEDIUM**

82. East Coast Bank offers to lend you $25,000 at a nominal rate of 7.5%, compounded monthly. The loan (principal plus interest) must be repaid at the end of the year. Midwest Bank also offers to lend you the $25,000, but it will charge an annual rate of 8.3%, with no interest due until the end of the year. What is the difference in the effective annual rates charged by the two banks?

a. 0.93%
b. 0.77%
c. 0.64%
d. 0.54%
e. 0.43%

(2.15) Nominal rate vs. EFF% **Answer: e MEDIUM**

83. Suppose a bank offers to lend you $10,000 for one year at a nominal annual rate of 10.25%, but you must make interest payments at the end of each quarter and then pay off the $10,000 principal amount at the end of the year. What is the effective annual rate on the loan?

a. 6.99%
b. 7.76%
c. 8.63%
d. 9.59%
e. 10.65%

(2.15) Nominal rate vs. EFF% **Answer: e MEDIUM**

84. Suppose a bank offers to lend you $10,000 for 1 year on a loan contract that calls for you to make interest payments of $250.00 at the end of each quarter and then pay off the principal amount at the end of the year. What is the effective annual rate on the loan?

a. 8.46%
b. 8.90%
c. 9.37%
d. 9.86%
e. 10.38%

(2.15) Nominal rate vs. EAR **Answer: e MEDIUM**

85. If a bank pays a 4.50% nominal rate, with monthly compounding on deposits, what effective annual rate (EFF%) does the bank pay?

a. 3.01%
b. 3.35%
c. 3.72%
d. 4.13%
e. 4.59%

(2.15) Nominal rate vs. EAR **Answer: b MEDIUM**

86. Suppose your credit card issuer states that it charges a 15.00% nominal annual rate. If you must make monthly payments, which amounts to monthly compounding, what is the effective annual rate?

a. 15.27%
b. 16.08%
c. 16.88%
d. 17.72%
e. 18.61%

(2.16) Interest charges, simple interest **Answer: c MEDIUM**

87. Pace Co. borrowed $25,000 at a rate of 7.25%, simple interest, with interest paid at the end of each month. The bank uses a 360-day year. How much interest would Pace have to pay in a 30-day month?

a. $136.32
b. $143.49
c. $151.04
d. $158.59
e. $166.52

(2.16) Fractional time periods **Answer: a MEDIUM**

88. Suppose you deposited $5,000 in a bank account that pays 5.25% with daily compounding and a 360-day year. How much could you withdraw after 8 months, assuming each month has 30 days?

a. $5,178.09
b. $5,436.99
c. $5,708.84
d. $5,994.28
e. $6,294.00

(2.17) Loan amortization: payment **Answer: a MEDIUM**

89. Suppose you borrowed $12,000 at a rate of 9% and must repay it in 4 equal installments at the end of each of the next 4 years. How large would your payments be?

a. $3,704.02
b. $3,889.23
c. $4,083.69
d. $4,287.87
e. $4,502.26

(2.17) Loan amortization: payment **Answer: c MEDIUM**

90. Suppose you are buying your first house for $210,000, and are making a $20,000 down payment. You have arranged to finance the remaining amount with a 30-year, monthly payment, amortized mortgage at a 6.5% nominal interest rate. What will your equal monthly payments be?

a. $1,083.84
b. $1,140.88
c. $1,200.93
d. $1,260.98
e. $1,324.02

(2.17) Loan amortization: interest **Answer: d MEDIUM**

91. Suppose you borrowed $12,000 at a rate of 9% and must repay it in 4 equal installments at the end of each of the next 4 years. How much interest would you have to pay in the first year?

a. $925.97
b. $974.70
c. $1,026.00
d. $1,080.00
e. $1,134.00

(2.17) Loan amortization: interest **Answer: d MEDIUM**

92. You plan to borrow $30,000 at a 7% annual interest rate. The terms require you to amortize the loan with 6 equal end-of-year payments. How much interest would you be paying in Year 2?

a. $1,548.79
b. $1,630.30
c. $1,716.11
d. $1,806.43
e. $1,896.75

(2.17) Loan amortization: interest **Answer: c MEDIUM**

93. You plan to borrow $75,000 at a 7% annual interest rate. The terms require you to amortize the loan with 10 equal end-of-year payments. How much interest would you be paying in Year 2?

a. $4,395.19
b. $4,626.52
c. $4,870.02
d. $5,113.52
e. $5,369.19

(2.17) Loan amortization: payment **Answer: e MEDIUM**

94. Suppose you take out a $10,000 loan at a 6% nominal annual rate. The terms of the loan require you to make 12 equal end-of-month payments each year for 4 years, and then an additional final (balloon) payment of $4,000 at the end of the last month. What will your equal monthly payments be?

a. $131.06
b. $137.96
c. $145.22
d. $152.86
e. $160.91

(2.18) Growing annuity: calculating the real rate **Answer: c MEDIUM**

95. You plan to make annual deposits into a bank account that pays a 5.00% nominal annual rate. You think inflation will amount to 2.50% per year. What is the expected annual real rate at which your money will grow?

a. 1.98%
b. 2.20%
c. 2.44%
d. 2.68%
e. 2.95%

(2.18) Growing annuity due: withdraw constant real amt Answer: e MEDIUM

96. Your father now has $1,000,000 invested in an account that pays 9.00%. He expects inflation to average 3%, and he wants to make annual constant dollar (real) beginning-of-year withdrawals over each of the next 20 years and end up with a zero balance after the 20th year. How large will his initial withdrawal (and thus constant dollar (real) withdrawals) be?

a. $66,154.58
b. $69,636.40
c. $73,301.47
d. $77,159.45
e. $81,220.47

(Comp: 2.10,2.15) Annuity due, N, monthly compounding Answer: d MEDIUM

97. You are considering investing in a Third World bank account that pays a nominal annual rate of 18%, compounded monthly. If you invest $5,000 at the beginning of each month, how many months will it take for your account to grow to $250,000? Round fractional years **up**.

a. 23
b. 27
c. 32
d. 38
e. 44

(Comp: 2.10,2.15) Annuity, N, monthly compounding Answer: b MEDIUM

98. You are considering investing in a bank account that pays a nominal annual rate of 6%, compounded monthly. If you invest $5,000 at the end of each month, how many months will it take for your account to grow to $200,000? Round fractional years **up**.

a. 33
b. 37
c. 41
d. 45
e. 49

(Comp: 2.10,2.15) Int rate, annuity, mos compounding Answer: d MEDIUM

99. Your child's orthodontist offers you two alternative payment plans. The first plan requires a $4,000 immediate up-front payment. The second plan requires you to make monthly payments of $137.41, payable at the end of each month for 3 years. What nominal annual interest rate is built into the monthly payment plan?

a. 12.31%
b. 12.96%
c. 13.64%
d. 14.36%
e. 15.08%

Medium/Hard:

(2.10) N, lifetime vs. annual pmts **Answer: e MEDIUM/HARD**

100. Your subscription to *Investing Wisely Weekly* is about to expire. You plan to subscribe to the magazine for the rest of your life, and you can renew it by paying $75 annually, beginning immediately, or you can get a lifetime subscription for $750, also payable immediately. Assuming you can earn 5.5% on your funds and the annual renewal rate will remain constant, how many years must you live to make the lifetime subscription the better buy? Round fractional years **up**. (Hint: Be sure to remember that you are solving for how many years you must live, not for how many payments must be made.)

a. 7
b. 8
c. 9
d. 11
e. 13

(2.15) Non-annual compounding **Answer: b MEDIUM/HARD**

101. You just deposited $2,500 in a bank account that pays a 12% nominal interest rate, compounded quarterly. If you also add another $5,000 to the account one year (12 months) from now and another $7,500 to the account two years from now, how much will be in the account three years (12 quarters) from now?

a. $17,422.59
b. $18,339.57
c. $19,256.55
d. $20,219.37
e. $21,230.34

(2.15) Compare effective cost of two bank loans **Answer: d MEDIUM/HARD**

102. Merchants Bank offers to lend you $30,000 at a nominal rate of 6.0%, simple interest, with interest paid quarterly. Gold Coast Bank offers to lend you the $30,000, but it will charge 7.0%, simple interest, with interest paid at the end of the year. What's the difference in the effective annual rates charged by the two banks?

a. 1.49%
b. 1.24%
c. 1.04%
d. 0.86%
e. 0.69%

(2.17) Loan amortization: principal repayment Answer: b MEDIUM/HARD

103. Suppose you borrowed $12,000 at a rate of 9% and must repay it in 4 equal installments at the end of each of the next 4 years. By how much would you reduce the amount you owe in the first year?

a. $2,492.82
b. $2,624.02
c. $2,755.23
d. $2,892.99
e. $3,037.64

(2.17) Loan amortization: ending balance Answer: e MEDIUM/HARD

104. Suppose you borrowed $12,000 at a rate of 9% and must repay it in 4 equal installments at the end of each of the next 4 years. How much would you still owe at the end of the first year, after you have made the first payment?

a. $7,636.79
b. $8,038.73
c. $8,461.82
d. $8,907.18
e. $9,375.98

(Comp: 2.2,2.10) Retirement planning Answer: c MEDIUM/HARD

105. Your sister turned 35 today, and she is planning to save $5,000 per year for retirement, with the first deposit to be made one year from today. She will invest in a mutual fund that will provide a return of 8% per year. She plans to retire 30 years from today, when she turns 65, and she expects to live for 25 years after retirement, to age 90. Under these assumptions, how much can she spend in each year after she retires? Her first withdrawal will be made at the end of her first retirement year.

a. $47,888
b. $50,408
c. $53,061
d. $55,714
e. $58,500

Hard:

(2.17) Loan amort: int rate, % of pmt toward principal Answer: e HARD

106. Your company has just taken out a 1-year installment loan for $72,500. The nominal rate is 12.0%, but with equal end-of-month payments. What percentage of the 2nd monthly payment will go toward the repayment of principal?

a. 73.01%
b. 76.85%
c. 80.89%
d. 85.15%
e. 89.63%

(2.17) Loan amort: pmt and % of pmt toward interest **Answer: b HARD**

107. A homeowner just obtained a 30-year amortized mortgage loan for $150,000 at a nominal annual rate of 6.5%, with 360 end-of-month payments. What percentage of the total payments made during the first 3 months will go toward payment of interest?

a. 81.34%
b. 85.62%
c. 89.90%
d. 94.40%
e. 99.12%

(2.18) Growing annuity: withdrawing constant real amt **Answer: e HARD**

108. Your father now has $1,000,000 invested in an account that pays 9.00%. He expects inflation to average 3%, and he wants to make annual constant dollar (real) end-of-year withdrawals over each of the next 20 years and end up with a zero balance after the 20th year. How large will his initial withdrawal (and thus constant dollar (real) withdrawals) be?

a. $68,139.22
b. $71,725.49
c. $75,500.52
d. $79,474.23
e. $83,657.08

(2.18) Growing annuity **Answer: c HARD**

109. You anticipate that you will need $1,500,000 when you retire 30 years from now. You plan to make 30 deposits, beginning today, in a bank account that will pay 6% interest, compounded annually. You expect to receive annual raises of 4%, so you will increase the amount you deposit each year by 4%. (That is, your 2nd deposit will be 4% greater than your first, the 3rd will be 4% greater than the 2nd, etc.) How much must your 1st deposit be if you are to meet your goal?

a. $10,216.60
b. $10,754.31
c. $11,320.33
d. $11,886.35
e. $12,480.66

(2.18) Growing annuity **Answer: a HARD**

110. You want to accumulate $2,500,000 in your 401(k) plan by your retirement date, which is 35 years from now. You will make 30 deposits into your plan, with the first deposit occurring today. The plan's rate of return typically averages 9%. You expect to increase each deposit by 2% as your income grows with inflation. (That is, your 2nd deposit will be 2% greater than your first, the 3rd will be 2% greater than the 2nd, etc.) How much must your 1st deposit at t = 0 be to enable you to meet your goal?

a. $8,718.90
b. $9,154.84
c. $9,612.58
d. $10,093.21
e. $10,597.87

(Comp: 2.7,2.10) Retirement planning **Answer: a HARD**

111. Steve and Ed are cousins who were both born on the same day. Both turned 25 today. Their grandfather began putting $2,500 per year into a trust fund for Steve on his 20th birthday, and he just made a 6th payment into the fund. The grandfather (or his estate's trustee) will continue with these $2,500 payments until a 46th and final payment is made on Steve's 65th birthday. The grandfather set things up this way because he wants Steve to work, not to be a "trust fund baby," but he also wants to ensure that Steve is provided for in his old age.

Until now, the grandfather has been disappointed with Ed, hence has not given him anything. However, they recently reconciled, and the grandfather decided to make an equivalent provision for Ed. He will make the first payment to a trust for Ed later today, and he has instructed his trustee to make additional equal annual payments each year until Ed turns 65, when the 41st and final payment will be made. If both trusts earn an annual return of 8%, how much must the grandfather put into Ed's trust today and each subsequent year to enable him to have the same retirement nest egg as Steve after the last payment is made on their 65th birthday?

a. $3,726
b. $3,912
c. $4,107
d. $4,313
e. $4,528

(Comp: 2.2,2.7) FV of uneven CF stream **Answer: d HARD**

112. After graduation, you plan to work for Dynamo Corporation for 12 years and then start your own business. You expect to save and deposit $7,500 a year for the first 6 years and $15,000 annually for the following 6 years, with the first deposit being made a year from today. In addition, your grandfather just gave you a $25,000 graduation gift which you will deposit immediately. If the account earns 9% compounded annually, how much will you have when you start your business 12 years from now?

a. $238,176
b. $250,712
c. $263,907
d. $277,797
e. $291,687

(Comp: 2.2,2.3,2.10,2.12) Find CF for given return **Answer: c HARD**

113. You are negotiating to make a 7-year loan of $25,000 to Breck Inc. To repay you, Breck will pay $2,500 at the end of Year 1, $5,000 at the end of Year 2, and $7,500 at the end of Year 3, plus a fixed but currently unspecified cash flow, X, at the end of Years 4 through 7. Breck is essentially riskless, so you are confident the payments will be made, and you regard 8% as an appropriate rate of return on low risk 7-year loans. What cash flow must the investment provide at the end of each of the final 4 years, that is, what is X?

a. $4,271.67
b. $4,496.49
c. $4,733.15
d. $4,969.81
e. $5,218.30

(Comp: 2.2,2.3,2.10,2.12) Saving for college **Answer: e HARD**

114. John and Daphne are saving for their daughter Ellen's college education. Ellen is now 10 years old and will be entering college 8 years from now (t = 8). College tuition and expenses at State U. are currently $14,500 a year, but they are expected to increase at a rate of 3.5% a year. They expect Ellen to graduate in 4 years. (If Ellen wants to go to graduate school, she will be on her own.) Tuition and other costs will be due at the beginning of each school year (at t = 8, 9, 10, and 11). So far, John and Daphne have accumulated $15,000 in the college savings account. Their long-run financial plan is to add an additional $5,000 at the beginning of each of the next 4 years (at t = 0, 1, 2, and 3). Then they plan to make 4 equal annual contributions at the end of each of the following 5 years (t = 4, 5, 6, 7, and 8). They expect their investment account to earn 9%. How large must the annual payments be at t = 4, 5, 6, 7, and 8 to meet Ellen's anticipated college costs?

a. $777.96
b. $818.91
c. $862.01
d. $907.38
e. $955.13

CHAPTER 2
ANSWERS AND SOLUTIONS

1. (2.2) Compounding **Answer: a EASY**

2. (2.3) PV versus FV **Answer: b EASY**

3. (2.3) PV versus FV **Answer: a EASY**

4. (2.15) Effective annual rate **Answer: b EASY**

5. (2.17) Amortization **Answer: a EASY**

6. (2.2) Compounding **Answer: b MEDIUM**

7. (2.2) Comparative compounding **Answer: a MEDIUM**

Work out the numbers with a calculator:

PV	1000	FV_A =	\$1,710.34
Rate on A	5%	$2*FV_A$ =	\$3,420.68
Rate on B	12%	FV_B =	\$3,478.55
Years	11	$FV_B > 2*FV_A$, so TRUE	

8. (2.3) PV of a sum **Answer: a MEDIUM**

9. (2.9) PV of an annuity **Answer: a MEDIUM**

One could make up an example and see that the statement is true. Alternatively, one could simply recognize that the PV of an annuity declines as the discount rate increases and recognize that more frequent compounding increases the effective rate.

10. (2.15) Effective and nominal rates **Answer: a MEDIUM**

11. (2.15) Periodic and nominal rates **Answer: a MEDIUM**

12. (2.17) Amortization **Answer: b MEDIUM**

13. (2.17) Amortization **Answer: b MEDIUM**

There is no reason to think that this statement would be true. Each portion of the payment representing interest declines, while each portion representing principal repayment increases. Therefore, the statement is clearly false. We could also work out some numbers to prove this point. Here's an example for a 3-year loan at a 10% annual interest rate. The interest component is never equal to the principal repayment component.

Original loan	1000
Rate	10%
Life	3
Payment	\$402.11

	Beg. Balance	Interest	Principal	Ending Bal.
1	\$1,000.00	\$100.00	\$302.11	\$697.89
2	\$697.89	\$69.79	\$332.33	\$365.56
3	\$365.56	\$36.56	\$365.56	\$0.00

14. (2.1) Time lines **Answer: a EASY**

15. (2.1) Time lines **Answer: b EASY**

16. (2.3) Effects of factors on PVs **Answer: b EASY**

17. (2.6) Annuities **Answer: d EASY**

18. (2.14) Solving for I with uneven cash flows **Answer: c MEDIUM**

19. (2.15) Effective annual rate **Answer: e MEDIUM**

By inspection, we can see that e dominates a and b, and that c dominates d because, with the same interest rate, the account with the most frequent compounding has the highest EFF%. Thus, the correct answer must be either e or c. Moreover, we can see by inspection that since c and e have the same compounding frequency yet e has the higher nominal rate, e must have the higher EFF%. You could also prove that e is the correct choice by calculating the EFF%s:

a. 8.300% $= (1+0.08/12)^{12} - 1$
b. 8.000% $= (1+0.08/1)^{1} - 1$
c. 7.250% $= (1+0.07/365)^{365} - 1$
d. 7.229% $= (1+0.07/12)^{12} - 1$
e. 8.328% $= (1+0.08/365)^{365} - 1$

20. (2.15) Quarterly compounding **Answer: c MEDIUM**

21. (2.17) Amortization **Answer: c MEDIUM**

a, d, and e can be ruled out as incorrect by simple reasoning. b is incorrect because interest in the first year would be Loan amount * interest rate regardless of the life of the loan. That makes c the "logical guess." It is also logical that the percentage of interest in each payment would be higher if the interest rate were higher. Think about the situation where r = 0%, so interest would be zero. One could also set up an amortization schedule and change the numbers to confirm that only c is correct.

22. (2.17) Amortization **Answer: a MEDIUM**

a is not correct because we would subtract principal repaid, not interest paid. Thus a is the correct response to this question. b is correct by definition. c is correct because the outstanding loan balance is declining. d is clearly correct, as is e. One could also set up an amortization schedule to prove that the above statements are correct.

23. (2.17) Amortization **Answer: b MEDIUM**

b is correct. a is clearly wrong, as are c and d. It is not obvious whether e is correct or not, but we could set up an example to see:

Loan	100000	Term	30
Rate	10%	Periods/Year	12
Periodic rate	0.0083333	Total periods	360
Payment	-$877.57	Interest month 1	$833.33

Interest as % of total payment: 95%, which is much larger than 10%.

24. (Comp: 2.2,2.7,2.8) Time value concepts **Answer: a MEDIUM**

You could just reason this out, or you could do calculations to manually see which one is largest, as we show below:
A dominates B because it receives the same total amount, but gets it faster, hence it can earn more interest over the 10 years. A also dominates C and E for the same reason, and it dominates D because with D no interest whatever is earned. We could also do these calculations to answer the question:

A	**$4,382.79**	**Largest**	EFF%	10.00%	10	250
B	$4,081.59		NOM%	9.76%		125
C	$4,280.81					125
D	$2,500.00					2500
E	$3,984.36					250

25. (Comp: 2.3,2.9,2.15) Various concepts **Answer: d MEDIUM**

26. (Comp: 2.2,2.9,2.15,2.17) Various concepts **Answer: c MEDIUM**

27. (Comp: 2.9,2.15,2.17) Various concepts **Answer: e MEDIUM**

28. (Comp: 2.7,2.8,2.9) Annuities **Answer: d MEDIUM**

29. (2.15) Effective annual rates **Answer: e HARD**

By inspection, we can see that e dominates b, c, and d because, with the same interest rate, the account with the most frequent compounding has the highest EFF%. Thus, the correct answer must be either a or e. However, we can cannot tell by inspection whether a or e provides the higher EFF%. We know that with one compounding period an EFF% is 6.1%, so we can calculate e's EFF%. It is 6.183%, so e is the correct answer.

a. $= (1+0.061/12)^{12} - 1 =$ 6.100%
e. $= (1+0.06/365)^{365} - 1 =$ 6.183%

30. (2.2) FV of a lump sum **Answer: d EASY**

N	8
I/YR	8.5%
PV	$125
PMT	$0
FV	**$240.08**

31. (2.2) FV of a lump sum **Answer: a EASY**

N	5
I/YR	3.5%
PV	$1,500
PMT	$0
FV	**$1,781.53**

32. (2.2) FV of a lump sum **Answer: c EASY**

N	5
I/YR	6.0%
PV	$225.00
PMT	$0.00
FV	**$301.10**

33. (2.2) FV of a lump sum **Answer: b EASY**

N	75
I/YR	3.5%
PV	$1.00
PMT	$0.00
FV	**$13.20**

34. (2.2) FV of a lump sum **Answer: b EASY**

N	25
I/YR	3.5%
PV	$1,000
PMT	$0
FV	**$2,363.24**

35. (2.3) PV of a lump sum **Answer: a EASY**

N	5
I/YR	5.5%
PMT	$0
FV	$1,000.00
PV	**$765.13**

36. (2.3) PV of a lump sum **Answer: e EASY**

N	50
I/YR	7.5%
PMT	$0
FV	$5,000
PV	**$134.45**

37. (2.3) PV of a lump sum **Answer: b EASY**

N	5
I/YR	4.25%
PMT	$0
FV	$2,500.00
PV	**$2,030.30**

38. (2.4) Interest rate on a lump sum **Answer: d EASY**

N	5
PV	$747.25
PMT	$0
FV	$1,000.00
I/YR	**6.00%**

39. (2.4) Growth rate **Answer: b EASY**

N	10
PV	$0.50
PMT	$0
FV	$2.20
I/YR	**15.97%**

40. (2.5) Number of periods **Answer: e EASY**

I/YR	3.8%
PV	$50.00
PMT	$0
FV	$150.00
N	**29.46**

41. (2.5) Number of periods **Answer: d EASY**

I/YR	9.0%
PV	$2.50
PMT	$0
FV	$5.00
N	**8.04**

42. (2.5) Number of periods **Answer: e EASY**

I/YR	9.0%
PV	$5,000.00
PMT	$0
FV	$9,140.20
N	**7.00**

43. (2.7) FV of an ordinary annuity **Answer: c EASY**

N	3
I/YR	5.2%
PV	$0.00
PMT	$4,200
FV	**$13,266.56**

44. (2.7) FV of an ordinary annuity **Answer: a EASY**

N	5
I/YR	8.5%
PV	$0.00
PMT	$3,100
FV	**$18,368.66**

45. (2.8) FV of an annuity due **Answer: a EASY**

N	3
I/YR	5.2%
PV	$0.00
PMT	$4,200
FV	**$13,956.42**

46. (2.8) FV of an annuity due **Answer: c EASY**

N	5
I/YR	8.5%
PV	$0.00
PMT	$3,100
FV	**$19,929.99**

47. (2.9) PV of an ordinary annuity **Answer: e EASY**

N	10
I/YR	6.5%
PMT	$2,700
FV	$0.00
PV	**$19,409.84**

48. (2.9) PV of an ordinary annuity **Answer: e EASY**

N	3
I/YR	5.5%
PMT	$1,200
FV	$0.00
PV	**$3,237.52**

49. (2.9) PV of an ordinary annuity **Answer: b EASY**

N	25
I/YR	6.25%
PMT	$65,000
FV	$0.00
PV	**$811,540.16**

50. (2.9) PV of an annuity due **Answer: a EASY**

N	10
I/YR	6.5%
PMT	$2,700
FV	$0.00
PV	**$20,671.48**

51. (2.9) PV of an annuity due **Answer: c EASY**

N	3
I/YR	5.5%
PMT	$550
FV	$0.00
PV	**$1,565.48**

52. (2.9) PV of an annuity due **Answer: d EASY**

N	25
I/YR	6.25%
PMT	$65,000
FV	$0.00
PV	**$862,261.42**

53. (2.9) PV of an annuity due **Answer: b EASY**

N	10
I/YR	8.5%
PMT	$30,000
FV	$0.00
PV	**$213,572**

54. (2.9) PV of an ordinary annuity plus an ending payment **Answer: e EASY**

N	4
I/YR	5.0%
PMT	$2,250
FV	$3,000
PV	**$10,446.50**

55. (2.10) Payments on an ordinary annuity **Answer: a EASY**

N	20
I/YR	8.25%
PV	$275,000
FV	$0.00
PMT	**$28,532.45**

56. (2.10) Payments on an ordinary annuity **Answer: d EASY**

N	25
I/YR	7.5%
PV	$375,000
FV	$0.00
PMT	**$33,641.50**

57. (2.10) Payments on an annuity due **Answer: c EASY**

N	25
I/YR	7.5%
PV	$375,000
FV	$0.00
PMT	**$31,294.42**

58. (2.10) Payments on an annuity due **Answer: d EASY**

N	20
I/YR	8.25%
PV	$275,000
FV	$0.00
PMT	**$26,357.92**

59. (2.10) Years to deplete an ordinary annuity **Answer: a EASY**

I/YR	7.5%
PV	$375,000
PMT	$35,000
FV	$0.00
N	**22.50**

60. (2.10) Years to deplete an annuity due **Answer: e EASY**

I/YR	7.5%
PV	$500,000
PMT	$40,000
FV	$0.00
N	**28.44**

61. (2.10) Interest rate implicit in an annuity **Answer: b EASY**

N	10
PV	$3,500,000
PMT	$500,000
FV	$0.00
I/YR	**7.07%**

62. (2.10) Interest rate implicit in an annuity **Answer: c EASY**

N	20
PV	$15,000,000
PMT	$1,050,000
FV	$0.00
I/YR	**3.44%**

63. (2.10) Interest rate implicit in an annuity due **Answer: e EASY**

N	12
PV	$120,000
PMT	$15,000
FV	$0.00
I/YR	**8.41%**

64. (2.11) PV of a perpetuity **Answer: b EASY**

I/YR	5.0%
PMT	$250
PV	**$5,000.00**

65. (2.11) Rate of return on a perpetuity **Answer: d EASY**

Cost (PV)	$950
PMT	$85
I/YR	**8.95%**

66. (2.12) PV of an uneven cash flow stream **Answer: e EASY**

I/YR = 6.25%

	0	1	2	3	4
CFs:	$0	$75	$225	$0	$300
PV of CFs:	$0	$71	$199	$0	$235

PV = $505.30 Find the individual PVs and sum them. Automate the
PV = $505.30 process using Excel or a calculator, by inputting the data into the cash flow register and pressing the NPV key.

67. (2.12) PV of an uneven cash flow stream **Answer: c EASY**

I/YR = 12.0%

	0	1	2	3	4
CFs:	$0	$1,500	$3,000	$4,500	$6,000
PV of CFs:	$0	$1,339	$2,392	$3,203	$3,813

PV = $10,746.99 Found using the Excel NPV function
PV = $10,746.99 Found by summing individual PVs.
PV = $10,746.99 Found using the calculator NPV key.

68. (2.12) PV of an uneven cash flow stream Answer: d EASY/MEDIUM

I/YR = 8.0%

	0	1	2	3
CFs:	$750	$2,450	$3,175	$4,400
PV of CFs:	$750	$2,269	$2,722	$3,493

PV = $9,233.43 Found by summing individual PVs.
PV = $9,233.43 Found with a calculator or Excel to automate the process. With a calculator, input the cash flows and I into the cash flow register, then press the NPV key.

69. (2.12) PV of an uneven cash flow stream Answer: a EASY/MEDIUM

I/YR = 6.0%

	0	1	2	3	4
CFs:	$0	$1,000	$2,000	$2,000	$2,000
PV of CFs:	$0	$943	$1,780	$1,679	$1,584

PV = $5,986.81 Found using the Excel NPV function
PV = $5,986.81 Found by summing individual PVs.
PV = $5,986.81 Found using the calculator NPV key.

70. (2.15) FV of a lump sum, semiannual compounding Answer: c EASY/MEDIUM

Years	5	
Periods/Yr	2	
Nom. I/YR	6.0%	
N = Periods	10	
PMT	$0	
I = I/Period	3.0%	
PV	$1,500	Could be found using a calculator, the equation, or Excel.
FV	**$2,015.87**	Note that we must first convert to periods and rate per period.

71. (2.15) PV of a lump sum, semiannual compounding Answer: d EASY/MEDIUM

Years	5	
Periods/Yr	2	
Nom. I/YR	6.0%	
FV	$1,500	
N = Periods	10	
PMT	$0	
I = I/Period	3.0%	Could be found using a calculator, the equation, or Excel.
PV	**$1,116.14**	Note that we must first convert to periods and rate per period.

72. (2.10) Years to deplete an ordinary annuity **Answer: b MEDIUM**

I/YR	7.50%
PV	$300,000
PMT	$35,000
FV	$25,000
N	**14.96**

73. (2.10) Years to deplete an annuity due **Answer: c MEDIUM**

I/YR	7.5%
PV	$300,000
PMT	$35,000
FV	$25,000
N	**13.27**

74. (2.10) Interest rate implicit in an annuity due **Answer: a MEDIUM**

N	24
PV	$0
PMT	$500
FV	$13,000
I/YR	**7.62%**

75. (2.11) Payments on a perpetuity **Answer: b MEDIUM**

Cost (PV)	$1,250	
I/YR	7.5%	
PMT	**$93.75**	Multiply cost by I.

76. (2.13) FV of an uneven cash flow stream **Answer: e MEDIUM**

I/YR = 6.5%

	0	1	2	3	4
CFs:	$0	$75	$225	$0	$300
FV of CFs:	$0	$91	$255	$0	$300

FV =	**$645.80**	Found by summing individual FVs.
FV =	**$645.80**	Found with the NFV key in some calculators.
FV =	**$645.80**	Found with a calculator by first finding the PV of the stream, then finding the FV of that PV.

PV of the stream: $501.99
FV of the PV: **$645.80**

77. (2.14) Interest rate built into uneven CF stream **Answer: c MEDIUM**

	0	1	2	3	4	5
CFs:	-$1,000	$75	$75	$75	$75	$75
						$1,000
	-$1,000	$75	$75	$75	$75	$1,075

I/YR **7.50%** I is the discount rate that causes the PV of the inflows to equal the initial negative CF, and is found with Excel's IRR function or by inputting the CFs into a calculator and pressing` the IRR key.

78. (2.14) Interest rate built into uneven CF stream **Answer: e MEDIUM**

	0	1	2	3	4
CFs:	-$725	$75	$100	$85	$625

I/YR **6.05%** I is the discount rate that causes the PV of the positive inflows to equal the initial negative CF. I can be found using Excel's IRR function or by inputting the CFs into a calculator and pressing the IRR key.

79. (2.15) FV of a lump sum, monthly compounding **Answer: b MEDIUM**

Years	5
Periods/Yr	12
Nom. I/YR	6.0%
N = Periods	60
PMT	$0
I/Period	0.5%
PV	$1,500
FV	**$2,023.28**

Could be found using a calculator, the equation, or Excel. Note that we must first convert to periods and rate per period.

80. (2.15) PV of a lump sum, monthly compounding **Answer: d MEDIUM**

Years	5
Periods/Yr	12
Nom. I/YR	6.0%
N = Periods	60
PMT	$0
I/Period	0.5%
FV	$1,525
PV	**$1,130.59**

Could be found using a calculator, the equation, or Excel. Note that we must first convert to periods and rate per period.

81. (2.15) APR vs. EAR **Answer: b MEDIUM**

APR	18.00%
Periods/yr	12
EFF%	**19.56%**

82. (2.15) Comparing the effective cost of two bank loans Answer: d MEDIUM

This problem can be worked most easily using the interest conversion feature of a calculator. It could also be worked using the conversion formula. We used the conversion formula.

Nominal rate, East Coast Bank	7.5%
Nominal rate, Midwest Bank	8.3%
Periods/yr, East Coast	12
Periods/yr, Midwest	1
EFF% East Coast	7.76%
EFF% Midwest	8.30%
Difference	**0.54%**

83. (2.15) Nominal rate vs. EFF% Answer: e MEDIUM

Nominal I/YR	10.25%	
Periods/yr	4	
EFF%	**10.65%**	Using conversion formula

You could also find the EFF% as follows:
Interest paid each quarter = Loan * rate/4 = quarterly PMT = $256.25

Then find the IRR as a quarterly rate and convert to an annual rate. This procedure is obviously longer.

	0	1	2	3	4
CFs:	10,000.00	-256.25	-256.25	-256.25	-256.25
					-10,000.00
	10,000.00	-256.25	-256.25	-256.25	-10,256.25

IRR (quarterly) = 2.56%
Annual effective rate = **10.65%** vs. nominal rate = 10.25%

84. (2.15) Nominal rate vs. EFF% Answer: e MEDIUM

Interest payment: $250.00

	0	1	2	3	4
CFs:	10,000.00	-250.00	-250.00	-250.00	-250.00
					-10,000.00
	10,000.00	-250.00	-250.00	-250.00	-10,250.00

IRR (quarterly) = 2.50%
Annual effective rate = **10.38%** vs. nominal rate = 10.00%

85. (2.15) Nominal rate vs. EAR Answer: e MEDIUM

Nominal I/YR	4.50%
Periods/yr	12
EFF%	**4.59%**

86. (2.15) Nominal rate vs. EAR **Answer: b MEDIUM**

Nominal I/YR	15.00%
Periods/yr	12
EFF%	**16.08%**

87. (2.16) Interest charges, simple interest **Answer: c MEDIUM**

Nominal I/YR	7.25%	Days in month	30
Days/yr	360	Daily rate	0.020139%
Amount borrowed	$25,000	Interest per day	$5.03472
Interest per month	**$151.04**		

88. (2.16) Fractional time periods **Answer: a MEDIUM**

Nominal I/YR	5.25%	Rate/day	0.0146%
Number of months	8	Days on deposit	240
Days in year	360		
Days in month	30		
Amount deposited	$5,000		
Ending amount	**$5,178.09**		

89. (2.17) Loan amortization: payment **Answer: a MEDIUM**

I/YR	9.0%	
Years	4	
Amount borrowed	$12,000	
Payments	**$3,704.02**	Found with a calculator, as the PMT.

90. (2.17) Loan amortization: payment **Answer: c MEDIUM**

Years	30	Payments/year	12
N	360	Nominal rate	6.50%
Periodic rate	0.54%	Purchase price	$210,000
PV	$190,000	Down payment	$20,000
FV	$0.00		
PMT	**$1,200.93**		

91. (2.17) Loan amortization: interest **Answer: d MEDIUM**

I/YR	9.0%	
Years	4	
Amount borrowed	$12,000	
Interest in Year 1	**$1,080.00**	Simply multiply the rate times the amount borrowed.

92. (2.17) Loan amortization: interest **Answer: d MEDIUM**

Find the required payment:

N	6
I/YR	7.0%
PV	$30,000
FV	$0
PMT	$6,293.87

Amortization schedule (first 2 years)

Year	Beg. Balance	Payment	Interest	Principal	End. Balance
1	30,000.00	6,293.87	2,100.00	4,193.87	25,806.13
2	25,806.13	6,293.87	**1,806.43**	4,487.45	21,318.68

93. (2.17) Loan amortization: interest **Answer: c MEDIUM**

Find the required payment:

N	10
I/YR	7.0%
PV	$75,000
FV	$0
PMT	$10,678.31

Amortization schedule (first 2 years)

Year	Beg. Balance	Payment	Interest	Principal	End. Balance
1	75,000.00	10,678.31	5,250.00	5,428.31	69,571.69
2	69,571.69	10,678.31	**4,870.02**	5,808.29	63,763.39

94. (2.17) Loan amortization: payment **Answer: e MEDIUM**

Years	4	Nominal rate	6.0%
N	48	Payments/year	12
I/YR	0.5%	Monthly annuity, so interest must be calculated on monthly basis	
PV	$10,000		
FV	$4,000		
PMT	**$160.91**		

95. (2.18) Growing annuity: calculating the real rate **Answer: c MEDIUM**

r_{NOM}	5.00%
Inflation	2.50%

$r_r = [(1 + r_{NOM})/(1 + \text{Inflation})] - 1$

$r_r =$ **2.44%**

96. (2.18) Growing annuity due: withdraw constant real amt Answer: e MEDIUM

r_{NOM}	9.00%	Initial sum	1,000,000
Inflation	3.00%	Years	20

$r_r = [(1 + r_{NOM})/(1 + \text{growth}] - 1$
$r_r = 5.825243\%$
PMT = **$81,220.47**

97. (Comp: 2.10,2.15) Annuity due, N, monthly compounding Answer: d MEDIUM

I/YR	18.0%	
I/MO	1.5%	Monthly annuity due, so interest must be calculated on monthly basis
PV	$0	
PMT	$5,000	
FV	$250,000	
N	**37.16**	**Rounded up 38**

98. (Comp: 2.10,2.15) Annuity, N, monthly compounding Answer: b MEDIUM

I/YR	6.0%	
I/MO	0.5%	Monthly annuity, so interest must be calculated on monthly basis
PV	$0	
PMT	$5,000	
FV	$200,000	
N	**36.56**	**Rounded up: 37**

99. (Comp: 2.10,2.15) Int rate, annuity, mos compounding Answer: d MEDIUM

N	36	
PV	$4,000	
PMT	$137.41	
FV	$0	
I/MO	1.20%	Monthly annuity, so interest must be calculated on monthly basis
I/YR	**14.36%**	

100. (2.10) N, lifetime vs. annual pmts Answer: e MEDIUM/HARD

Find N for an annuity due with the indicated terms to determine how long you must live to make the lifetime subscription worthwhile.

Interest rate	5.5%	
Annual cost	$75	
Lifetime subscription cost	$750	
Number of payments made	13.76	Rounded up: 14

Recall that we used BEGIN mode (because it is an annuity due), so it takes 14 payments to make the lifetime subscription better. Since the 1st payment occurs today, the 14th payment occurs at t = 13, which is 13 years from now.

So, you must live for: 14 − 1 = **13 years**. **13**

101. (2.15) Non-annual compounding **Answer: b MEDIUM/HARD**

Interest rate	12.0%
Periods/year	4
Quarterly rate	3.0%
1st deposit	$2,500
2nd deposit	$5,000
3rd deposit	$7,500

Years on Deposit	Quarters on Deposit	Ending Amount
3	12	$3,564.40
2	8	$6,333.85
1	4	$8,441.32
		$18,339.57

102. (2.15) Compare effective cost of two bank loans **Answer: d MEDIUM/HARD**

Students must understand that "simple interest with interest paid quarterly" means that the bank gets the interest at the end of each quarter, hence it can invest it, presumably at the same nominal rate. This results in the same effective rate as if it were stated as "6%, quarterly compounding."

Nominal rate, Merchants Bank	6.0%
Periods/yr, Merchants	4
Nominal rate, Gold Coast Bank	7.0%
Periods/yr, Gold Coast	1
EFF% Merchants	6.14%
EFF% Gold coast	7.00%
Difference	**0.86%**

103. (2.17) Loan amortization: principal repayment **Answer: b MEDIUM/HARD**

Interest rate	9.0%
Years	4
Amount borrowed	$12,000

Step 1: Find the PMT	$3,704.02
Step 2: Find the 1st year's interest	$1,080.00
Step 3: Subtract the interest from the payment; this is repayment of principal	**$2,624.02**

104. (2.17) Loan amortization: ending balance **Answer: e MEDIUM/HARD**

Interest rate	9.0%
Years	4
Amount borrowed	$12,000

Step 1: Find the PMT	$3,704.02
Step 2: Find the 1st year's interest	$1,080.00
Step 3: Subtract the interest from the payment; this is repayment of principal	$2,624.02
Step 4: Subtract the repayment of principal from the beginning amount owed	**$9,375.98**

105. (Comp: 2.2,2.10) Retirement planning **Answer: c MEDIUM/HARD**

Interest rate	8.0%
Years to retirement	30
Years in retirement	25
Amount saved per year	$5,000

Step 1: Find the amount at age 65; use the FV function $566,416
Step 2: Find the PMT for a 25-year ordinary annuity using that FV as the PV **$53,061**

106. (2.17) Loan amort: int rate, % of pmt toward principal **Answer: e HARD**

N	12	
r_{NOM}	12.0%	
Periodic r	1.0%	
PV	$72,500	
PMT	$6,442	
FV	$0	% paid toward prin. = **89.63%**

Amortization schedule(first 4 years)

Month	Beg. Balance	Payment	Interest	Principal	Ending Balance
1	72,500.00	6,441.54	725.00	5,716.54	66,783.46
2	66,783.46	6,441.54	667.83	5,773.70	61,009.76
3	61,009.76	6,441.54	610.10	5,831.44	55,178.32
4	55,178.32	6,441.54	551.78	5,889.75	49,288.57

107. (2.17) Loan amort: pmt and % of pmt toward interest **Answer: b HARD**

Years	30	Periods/yr	12
Nominal r	6.50%	N (12 mo.)	360
PV	$150,000	I/YR	0.54%
FV	$0	Total pmts	$2,844.31
PMT	$948.10	Interest	$2,435.29
		% interest	**85.62%**

Amortization schedule(first 3 months)

Year	Beg. Balance	Payment	Interest	Principal	Ending Balance
1	150,000.00	948.10	812.50	135.60	149,864.40
2	149,864.40	948.10	811.77	136.34	149,728.06
3	149,728.06	948.10	811.03	137.08	149,590.99
Total payments:		2,844.31	2,435.29	409.01	

108. (2.18) Growing annuity: withdrawing constant real amt **Answer: e HARD**

r_{NOM}	9.00%	Initial sum	1,000,000
Inflation	3.00%	Years	20

$r_r = [(1 + r_{NOM})/(1 + \text{growth}] - 1$
$r_r = 5.825243\%$
PMT = $81,220.47
Adj. PMT = **$83,657.08**

109. (2.18) Growing annuity **Answer: c HARD**

Step 1. Calculate the purchasing power of $1,500,000 in 30 years at an inflation rate of 4%:

N	30
I/YR	4.0%
PMT	$0.00
FV	$1,500,000
PV	$462,478.00

Step 2. Calculate the real rate of return on the growing annuity:

r_{NOM}	6.0%
Inflation	4.0%

$r_r = [(1 + r_{NOM})/(1 + \text{Inflation})] - 1$
$r_r = 1.92308\%$

Step 3. Calculate the required initial payment of the growing annuity by using inputs converted to "real" terms:

N	30
I/YR	1.92308%
PV	$0.00
FV	462,478.00
PMT	**$11,320.33**

110. (2.18) Growing annuity **Answer: a HARD**

Step 1. Calculate the purchasing power of $2,500,000 in 35 years at an inflation rate of 2%:

N	35
I/YR	2.0%
PMT	$0.00
FV	$2,500,000
PV	$1,250,069.03

Step 2. Calculate the real rate on the growing annuity:

r_{NOM}	9.0%
Inflation	2.0%

$r_r = [(1 + r_{NOM})/(1 + \text{Inflation})] - 1$

$r_r = 6.86275\%$

Step 3. Calculate the required initial payment of the growing annuity by using inputs converted to "real" terms:

N	35
I/YR	6.86275%
PV	$0.00
FV	1,250,069.03
PMT	**$8,718.90**

111. (Comp: 2.7,2.10) Retirement planning **Answer: a HARD**

Steve's retirement account			Ed's retirement account	
No. of payments thus far, at end of day		6		1
Number of remaining payments		40		40
N		46	N	41
I/YR		8.0%	I/YR	8.0%
PV		$0	PV	$0
PMT		$2,500	FV	$1,046,065
FV	Ed's FV should equal this:	$1,046,065	PMT	**$3,726**

112. (Comp: 2.2,2.7) FV of uneven CF stream **Answer: d HARD**

There are 3 cash flow streams: the gift and the two annuities. The gift will grow for 12 years. Then there is a 6-year annuity that will compound for an additional 6 years. Finally, there is a second 6-year annuity. The sum of the compounded values of those three sets of cash flows is the final amount.

		Amount at Year 6	Amount at Year 12
Interest rate	9.0%		
1st annuity	$7,500	$56,425	$94,630
2nd annuity	$15,000	NA	$112,850
Gift	$25,000	NA	$70,317
Total years	12		
Annuity years	6		Final amt: **$277,797**

113. (Comp: 2.2,2.3,2.10,2.12) Find CF for given return **Answer: c HARD**

This is a relatively easy problem to work with Excel, but it is quite difficult to work it with a calculator because it is hard to conceptualize how to set it up for an efficient calculator solution. We would not use it for a regular classroom exam, but it might be appropriate for a take-home or online exam.

I = 8%

0	1	2	3	4	5	6	7
-$25,000	$2,500	$5,000	$7,500	X	X	X	X

Calculator solution:

Step 1. Use the CF register to find the NPV of the 4 known cash flows, CF_0 to CF_3: -$12,444.75
Step 2. Find the FV of this NPV at the end of period 3, i.e., compound the NPV for 3 years. -$15,676.80
Step 3. Now find the PMT for a 4-year annuity with this PV. **$4,733.15**

Excel solution:

Set the problem up as shown below. Put a guess—we initially guessed $5,000—in the boxed cell under the first X. The IRR initially is greater than 8%, so lower the guess, and keep iterating until IRR = 8%. This value of X is the required payment for the investment to provide the 8% rate of return. The problem can be worked faster if you use Goal Seek. Here you would highlight the cell with the IRR, then tell Excel to change the Year 4 cell reference to the value that causes IRR = 8%. It turns out to be $4,733.15. If input values are changed PMT does not change automatically—you must repeat this step again.

0	1	2	3	4	5	6	7
-$25,000	$2,500	$5,000	$7,500	**$4,733.15**	$4,733.15	$4,733.15	$4,733.15

IRR = 8.00%

114. (Comp: 2.2,2.3,2.10,2.12) Saving for college **Answer: e HARD**

Current college costs	$14,500
College cost inflation	3.5%
Account return	9.0%
First 4 payments	$5,000
Current account balance	$15,000

First, determine each year of college's costs.

Year 1 of college (t = 8)	= 19,093.73
Year 2 of college (t = 9)	= 19,762.01
Year 3 of college (t = 10)	= 20,453.68
Year 4 of college (t = 11)	= 21,169.56

The PV (at t = 8) of all college costs is: 70,786.26. This is what they need at t = 8.

After the first 4 payments, the college account will have (at t = 3): $42,291.08

5 more contributions are left in order to get the required funds for college costs.

N	5
I	9.0%
PV	$42,291
FV	$70,786.26
PMT	**$955.13**

This problem can also be solved with Excel using Goal Seek:

Period = t		College Costs:	Need to Have at t = 8	FV of Initial Balance	Payments:	FV of Pmts
now	0	14,500.00		15,000.00	5,000.00	9,962.81
	1	15,007.50			5,000.00	9,140.20
	2	15,532.76			5,000.00	8,385.50
	3	16,076.41			5,000.00	7,693.12
	4	16,639.08			955.13	1,348.25
	5	17,221.45			955.13	1,236.92
	6	17,824.20			955.13	1,134.79
	7	18,448.05			955.13	1,041.09
	8	19,093.73	70,786.26	29,888.44	955.13	955.13
	9	19,762.01				40,897.82
	10	20,453.68				
	11	21,169.56	Amt. needed – FV initial bal – FV of Pmts = 0.00			

Use Goal Seek to set blue pmt such that we get zero for the pink sum. Note that the Goal Seek solution step must be repeated again if input values change. It doesn't change automatically with input changes.