

CHAPTER 2 TIME VALUE OF MONEY

(Difficulty Levels: Easy, Easy/Medium, Medium, Medium/Hard, and Hard)

PART I – New and Revised Carryover Problems and Questions

Multiple Choice: Problems

FV of a lump sum

Answer: a EASY

1. What would the future value of \$100 be after 5 years at 10% compound interest?
- a. \$161.05
 - b. \$134.54
 - c. \$127.84
 - d. \$151.29
 - e. \$143.65

FV of a lump sum

Answer: c EASY

2. Suppose you have \$2,000 and plan to purchase a 3-year certificate of deposit (CD) that pays 4% interest, compounded annually. How much will you have when the CD matures?
- a. \$2,324.89
 - b. \$2,591.45
 - c. \$2,249.73
 - d. \$2,011.87
 - e. \$2,854.13

FV of a lump sum

Answer: e EASY

3. A company's 2005 sales were \$100 million. If sales grow at 8% per year, how large will they be 10 years later, in 2015, in millions?
- a. \$190.49
 - b. \$225.54
 - c. \$188.32
 - d. \$201.15
 - e. \$215.89

FV of a lump sum

Answer: b EASY

4. How much would \$1, growing at 5% per year, be worth after 100 years?
- a. \$141.05
 - b. \$131.50
 - c. \$164.52
 - d. \$144.50
 - e. \$155.94

PV of a lump sum

Answer: d EASY

5. Suppose a U.S. government bond promises to pay \$2,249.73 three years from now. If the going interest rate on 3-year government bonds is 6%, how much is the bond worth today?
- a. \$2,011.87
 - b. \$2,591.45
 - c. \$2,324.89
 - d. \$1,888.92
 - e. \$2,854.13

PV of a lump sum

Answer: a EASY

6. How much would \$10,000 due in 100 years be worth today if the discount rate were 10%?
- a. \$0.73
 - b. \$1.21
 - c. \$2.49
 - d. \$4.83
 - e. \$6.30

PV of a lump sum

Answer: c EASY

7. Suppose a U.S. government bond will pay \$1,000 three years from now. If the going interest rate on 3-year government bonds is 4%, how much is the bond worth today?
- a. \$943.46
 - b. \$991.43
 - c. \$889.00
 - d. \$907.91
 - e. \$968.40

Interest rate on a simple lump sum investment

Answer: e EASY

8. The U.S. Treasury offers to sell you a bond for \$613.81. No payments will be made until the bond matures 10 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. 5.91%
 - b. 6.71%
 - c. 7.10%
 - d. 5.59%
 - e. 5.00%

Simple growth rate**Answer: b EASY**

9. Sims Inc. earned \$1.00 per share in 2000. Five years later, in 2005, it earned \$2.00. What was the growth rate in Sims' earnings per share (EPS) over the 5-year period?
- a. 10.82%
 - b. 14.87%
 - c. 13.61%
 - d. 14.28%
 - e. 12.17%

Number of periods**Answer: e EASY**

10. How long would it take \$100 to double if it were invested in a bank that pays 5% per year?
- a. 15.27 years
 - b. 10.49 years
 - c. 11.34 years
 - d. 13.91 years
 - e. 14.21 years

Number of periods**Answer: a EASY**

11. Addico Corp's 2005 earnings per share were \$2, and its growth rate during the prior 5 years was 11.0% per year. If that growth rate were maintained, how long would it take for Addico's EPS to double?
- a. 6.64 years
 - b. 6.81 years
 - c. 6.99 years
 - d. 7.13 years
 - e. 7.28 years

FV of an ordinary annuity**Answer: c EASY**

12. You want to buy a condo 5 years from now, and you plan to save \$3,000 per year, beginning one year from today. You will deposit the money in an account that pays 6% interest. How much will you have just after you make the 5th deposit, 5 years from now?
- a. \$14,764.40
 - b. \$13,431.83
 - c. \$16,911.28
 - d. \$17,843.15
 - e. \$15,119.76

FV of an ordinary annuity

Answer: e EASY

13. You want to go to grad school 3 years from now, and you can save \$5,000 per year, beginning one year from today. You plan to deposit the funds in a mutual fund which you expect to return 9% per year. Under these conditions, how much will you have just after you make the 3rd deposit, 3 years from now?
- a. \$18,349.15
 - b. \$16,110.34
 - c. \$17,513.68
 - d. \$17,976.84
 - e. \$16,390.50

FV of an annuity due

Answer: b EASY

14. You want to buy a condo 5 years from now, and you plan to save \$3,000 per year, beginning immediately. You will make 5 deposits in an account that pays 6% interest. Under these assumptions, how much will you have 5 years from today?
- a. \$16,110.34
 - b. \$17,925.96
 - c. \$17,513.68
 - d. \$15,976.84
 - e. \$18,349.15

FV of an annuity due

Answer: d EASY

15. You want to go to grad school 3 years from now, and you can save \$5,000 per year, beginning immediately. You plan to deposit the funds in a mutual fund which you expect to return 9% per year. Under these conditions, how much will you have just after you make the 3rd deposit, 3 years from now?
- a. \$14,976.84
 - b. \$16,110.34
 - c. \$17,513.68
 - d. \$17,865.65
 - e. \$18,349.15

PV of an ordinary annuity

Answer: a EASY

16. What is the PV of an ordinary annuity with 5 payments of \$3,000 if the appropriate interest rate is 5%?
- a. \$12,988.43
 - b. \$13,431.83
 - c. \$14,764.40
 - d. \$17,843.15
 - e. \$15,119.76

PV of an ordinary annuity

Answer: c EASY

17. You have a chance to buy an annuity that pays \$1,000 at the end of each year for 5 years. You could earn 6% on your money in other investments with equal risk. What is the most you should pay for the annuity?
- a. \$3,324.89
 - b. \$2,591.45
 - c. \$4,212.36
 - d. \$2,011.87
 - e. \$3,854.13

PV of an ordinary annuity

Answer: e EASY

18. Your father is about to retire, and he wants to buy an annuity that will provide him with \$50,000 of income per year for 20 years, beginning a year from today. The going rate on such annuities is 6%. How much would it cost him to buy such an annuity today?
- a. \$488,349.15
 - b. \$416,110.34
 - c. \$517,513.68
 - d. \$615,976.84
 - e. \$573,496.06

PV of an annuity due

Answer: b EASY

19. What is the PV of an annuity due with 5 payments of \$3,000 at an interest rate of 5%?
- a. \$11,110.34
 - b. \$13,637.85
 - c. \$12,513.68
 - d. \$14,976.84
 - e. \$15,349.15

PV of an annuity due

Answer: d EASY

20. You have a chance to buy an annuity that pays \$1,000 at the beginning of each year for 5 years. You could earn 6% on your money in other investments with equal risk. What is the most you should pay for the annuity?
- a. \$2,854.13
 - b. \$2,591.45
 - c. \$3,324.89
 - d. \$4,465.11
 - e. \$5,011.87

PV of an annuity due

Answer: a EASY

21. Your father is about to retire, and he wants to buy an annuity that will provide him with \$50,000 of income a year for 20 years, with the first payment coming immediately. The going rate on such annuities is 6%. How much would it cost him to buy the annuity today?
- a. \$607,905.82
 - b. \$416,110.34
 - c. \$517,513.68
 - d. \$615,976.84
 - e. \$488,349.15

Payments on an ordinary annuity

Answer: c EASY

22. Suppose you inherited \$200,000 and invested it at 6% per year. How much could you withdraw at the end of each of the next 15 years?
- a. \$24,764.40
 - b. \$23,431.83
 - c. \$20,592.55
 - d. \$17,843.15
 - e. \$15,119.76

Payments on an ordinary annuity

Answer: e EASY

23. Your father has \$500,000 and wants to retire. He expects to live for another 20 years, and to be able to earn 8% on his invested funds. How much could he withdraw at the end of each of the next 20 years and end up with zero in the account?
- a. \$55,119.76
 - b. \$53,431.83
 - c. \$54,764.40
 - d. \$47,843.15
 - e. \$50,926.10

Payments on an annuity due

Answer: b EASY

24. Your father has \$500,000 and wants to retire. He expects to live for another 20 years, and he also expects to earn 8% on his invested funds. How much could he withdraw at the beginning of each of the next 20 years and end up with zero in the account?
- a. \$53,431.83
 - b. \$47,153.80
 - c. \$54,764.40
 - d. \$47,843.15
 - e. \$45,119.76

Payments on an annuity due

Answer: d EASY

25. Suppose you inherited \$200,000 and invested it at 6% per year. How much could you withdraw at the beginning of each of the next 15 years?
- a. \$17,843.15
 - b. \$13,431.83
 - c. \$14,764.40
 - d. \$19,426.94
 - e. \$15,119.76

Years to deplete an ordinary annuity

Answer: a EASY

26. Your father has \$500,000 invested at 8%, and he now wants to retire. He wants to withdraw \$50,000 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. 20.91 years
 - b. 18.49 years
 - c. 11.34 years
 - d. 13.91 years
 - e. 15.27 years

Years to deplete an annuity due

Answer: c EASY

27. Your father has \$500,000 invested at 8%, and he now wants to retire. He wants to withdraw \$50,000 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. 11.34 years
 - b. 18.49 years
 - c. 17.54 years
 - d. 13.91 years
 - e. 15.27 years

Interest rate implicit in an annuity

Answer: e EASY

28. You just won the state lottery. The state gives you the choice of \$1,000,000 today or a 20-year annuity of \$75,000, with the first payment coming one year from today. What rate of return is built into the annuity?
- a. 5.91%
 - b. 6.71%
 - c. 7.10%
 - d. 5.59%
 - e. 4.22%

Interest rate implicit in an annuity

Answer: b EASY

29. Your girlfriend just won the Power Ball lottery. She has the choice of \$10,000,000 today or a 30-year annuity of \$500,000, with the first payment coming today. What rate of return is built into the annuity?
- a. 2.71%
 - b. 3.08%
 - c. 4.10%
 - d. 3.59%
 - e. 3.91%

Interest rate implicit in an annuity

Answer: d EASY

30. Assume that you own an annuity that will pay you \$10,000 per year for 10 years, with the first payment being made today. Your girlfriend's father offers to give you \$45,000 for the annuity. If you sell it, what rate of return would your girlfriend's father earn on his investment?
- a. 25.59%
 - b. 26.71%
 - c. 17.10%
 - d. 24.63%
 - e. 22.91%

PV of an annuity due

Answer: a EASY

31. You own an oil well that will pay you \$25,000 per year for 8 years, with the first payment being made today. If you think a fair return on the well is 7%, how much should you ask if you decide to sell it?
- a. \$159,732
 - b. \$116,110
 - c. \$217,513
 - d. \$315,976
 - e. \$288,349

PV of an ordinary annuity plus an ending payment

Answer: c EASY

32. What's the present value of a 6-year ordinary annuity of \$1,000 per year plus an additional \$1,500 at the end of Year 6 if the interest rate is 6%?
- a. \$5,324.89
 - b. \$5,591.45
 - c. \$5,974.77
 - d. \$6,011.87
 - e. \$4,854.13

PV of a perpetuity**Answer: e EASY**

33. What's the present value of a perpetuity that pays \$100 per year if the appropriate interest rate is 6%?
- a. \$2,854.13
 - b. \$2,591.45
 - c. \$1,324.89
 - d. \$1,011.87
 - e. \$1,666.67

Rate of return on a perpetuity**Answer: b EASY**

34. What's the rate of return you would earn if you paid \$1,500 for a perpetuity that pays \$105 per year?
- a. 6.71%
 - b. 7.00%
 - c. 7.30%
 - d. 5.59%
 - e. 5.91%

Dollar payments on a perpetuity**Answer: d EASY**

35. What annual payment would you have to receive in order to earn an 8% rate of return on a perpetuity that cost \$1,500?
- a. \$127.84
 - b. \$134.54
 - c. \$151.29
 - d. \$120.00
 - e. \$143.65

PV of an uneven cash flow stream**Answer: a EASY**

36. At a rate of 8%, what is the present value of the following cash flow stream? \$0 at Time 0; \$100 at the end of Year 1; \$300 at the end of Year 2; \$0 at the end of Year 3; and \$500 at the end of Year 4?
- a. \$717.31
 - b. \$625.54
 - c. \$788.32
 - d. \$701.15
 - e. \$690.49

PV of an uneven cash flow stream**Answer: c EASY/MEDIUM**

37. An investment promises the following cash flow stream: \$1,000 at Time 0; \$2,000 at the end of Year 1 (or at T=1); \$3,000 at the end of Year 2; and \$5,000 at the end of Year 3. At a discount rate of 5%, what is the present value of the cash flow stream?
- a. \$9,324.89
 - b. \$9,591.45
 - c. \$9,945.04
 - d. \$9,011.87

e. \$9,854.13

FV of a lump sum, semiannually

Answer: e EASY/MEDIUM

38. What's the future value of \$2,000 after 3 years if the appropriate interest rate is 8%, compounded semiannually?

- a. \$2,854.13
- b. \$2,781.45
- c. \$2,324.89
- d. \$2,011.87
- e. \$2,530.64

PV of a lump sum, semiannually

Answer: b EASY/MEDIUM

39. What's the present value of \$2,000 discounted back 3 years if the appropriate interest rate is 8%, compounded semiannually?

- a. \$1,110.34
- b. \$1,580.63
- c. \$1,413.68
- d. \$1,976.84
- e. \$1,349.15

FV of an uneven cash flow stream

Answer: d MEDIUM

40. At a rate of 8%, what is the future value of the following cash flow stream? \$0 at Time 0; \$100 at the end of Year 1; \$300 at the end of Year 2; \$0 at the end of Year 3; and \$500 at the end of Year 4?

- a. \$907.91
- b. \$991.43
- c. \$943.46
- d. \$975.89
- e. \$968.40

Interest rate built into an uneven cash flow stream

Answer: a MEDIUM

41. An investment costs \$1,000 (CF at $T = 0$) and is expected to produce cash flows of \$50 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. 5.0%
- b. 6.7%
- c. 7.1%
- d. 5.5%
- e. 5.9%

Interest rate built into an uneven cash flow stream

Answer: c MEDIUM

42. An investment costs \$500 and is expected to produce cash flows of \$50 at the end of Year 1, \$60 at the end of Year 2, \$70 at the end of Year 3, and \$516 at the end of Year 4. What rate of return would you earn if you bought this investment?
- a. 11.1%
 - b. 12.7%
 - c. 10.0%
 - d. 9.5%
 - e. 10.9%

FV of a lump sum, monthly

Answer: e MEDIUM

43. What's the future value of \$2,000 after 3 years if the appropriate interest rate is 8%, compounded monthly?
- a. \$2,854.13
 - b. \$2,491.45
 - c. \$2,324.89
 - d. \$2,011.87
 - e. \$2,540.47

PV of a lump sum, monthly

Answer: b MEDIUM

44. What's the present value of \$2,000 discounted back 3 years if the appropriate interest rate is 8%, compounded monthly?
- a. \$1,491.45
 - b. \$1,574.51
 - c. \$1,324.89
 - d. \$1,011.87
 - e. \$1,854.13

APR vs. effective annual rate

Answer: d MEDIUM

45. Credit card issuers must by law print their Annual Percentage Rate (APR) on their monthly statements. If the APR is stated to be 15%, with interest paid monthly, what is the EFF% on the card?
- a. 15.59%
 - b. 16.71%
 - c. 17.10%
 - d. 16.08%
 - e. 12.91%

Nominal vs. effective annual rate

Answer: a MEDIUM

46. If a bank pays a 6% nominal rate, with monthly compounding, on deposits, what effective annual rate does the bank pay?
- a. 6.17%
 - b. 6.71%
 - c. 5.10%
 - d. 6.59%

e. 5.91%

Interest charges, simple interest

Answer: c MEDIUM

47. Columbus Corp. borrowed \$10,000 at a rate of 8%, simple interest, with interest paid at the end of each month. The bank uses a 360-day year. How much interest would the firm have to pay in a 30-day month?
- a. \$27.84
 - b. \$34.54
 - c. \$66.67
 - d. \$51.29
 - e. \$43.65

Fractional time periods

Answer: e MEDIUM

48. Suppose you deposited \$5,000 in a bank account that pays 6% with daily compounding and a 360-day year. How much could you withdraw after 7 months, assuming each month has 30 days?
- a. \$5,854.13
 - b. \$5,591.45
 - c. \$5,324.89
 - d. \$5,011.87
 - e. \$5,178.08

Loan amortization: payment

Answer: b MEDIUM

49. Suppose you borrowed \$25,000 at a rate of 8% 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. \$7,691.45
 - b. \$7,548.02
 - c. \$7,324.89
 - d. \$7,011.87
 - e. \$7,854.13

Loan amortization: interest

Answer: d MEDIUM

50. Suppose you borrowed \$25,000 at a rate of 8% 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. \$2,081.87
 - b. \$2,591.45
 - c. \$2,324.89
 - d. \$2,000.00
 - e. \$2,854.13

Comparing the effective cost of two bank loans

Answer: a MEDIUM

51. Bank A offers to lend you \$10,000 at a nominal rate of 7%, compounded monthly. The loan (principal plus interest) must be repaid at the end of the year. Bank B also offers to lend you the \$10,000, but it will charge 8%, with interest due at the end of the year. What is the difference in the effective annual rates charged by the two banks?
- a. 0.77%
 - b. 1.71%
 - c. 1.10%
 - d. 1.59%
 - e. 0.91%

Mortgage payments

Answer: c MEDIUM

52. You are buying your first house for \$220,000, and are paying \$30,000 as a down payment. You have arranged to finance the remaining \$190,000 30-year mortgage with a 7% nominal interest rate and monthly payments. What are the equal monthly payments you must make?
- a. \$1,513
 - b. \$1,110
 - c. \$1,264
 - d. \$1,976
 - e. \$1,349

Loan amortization: principal repayment

Answer: e MEDIUM/HARD

53. Suppose you borrowed \$25,000 at a rate of 8% 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. \$5,349
 - b. \$6,110
 - c. \$6,513
 - d. \$4,976
 - e. \$5,548

Loan amortization: ending balance

Answer: b MEDIUM/HARD

54. Suppose you borrowed \$25,000 at a rate of 8% 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. \$21,110
 - b. \$19,452
 - c. \$18,513
 - d. \$18,976
 - e. \$19,049

Retirement planning**Answer: d MEDIUM/HARD**

55. Your sister turned 30 today, and she is planning to save \$3,000 per year for retirement, with the first deposit to be made one year from today. She will invest in a mutual fund, which she expects to provide a return of 10% per year. She plans to retire 35 years from today, when she turns 65, and she expects to live for 30 years after retirement, to age 95. 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. \$78,976
 - b. \$91,110
 - c. \$88,513
 - d. \$86,250
 - e. \$83,049

Non-annual compounding**Answer: a MEDIUM/HARD**

56. You just deposited \$5,000 in a bank account that pays a 12% nominal interest rate, compounded monthly. If you also add another \$10,000 to the account one year (12 months) from now and another \$15,000 to the account two years from now, how much will be in the account three years (36 months) from now?
- a. \$36,753.57
 - b. \$33,431.83
 - c. \$34,764.40
 - d. \$37,843.15
 - e. \$35,119.76

Lifetime subscription vs. annual payments**Answer: c MEDIUM/HARD**

57. Your subscription to Making Money Monthly is about to run out. You plan to take the magazine for the rest of your life, and you can renew it by paying \$100 per year, beginning immediately, or you can get a lifetime subscription for \$1,000, payable immediately. Assuming you can earn 7% on your capital and the annual renewal rate will remain constant, how many years must you live to make the lifetime subscription the better buy? Round up if necessary to obtain a whole number of years. (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. 16 years
 - b. 14 years
 - c. 15 years
 - d. 17 years
 - e. 13 years

Comparing the effective cost of two bank loans

Answer: e MEDIUM/HARD

58. Bank A offers to lend you \$10,000 at a nominal rate of 6%, simple interest, with interest paid monthly. Bank B offers to lend you the \$10,000, but it will charge 7%, simple interest, with interest paid at the end of the year. What is the difference in the effective annual rates charged by the two banks?
- a. 1.17%
 - b. 1.12%
 - c. 0.91%
 - d. 1.28%
 - e. 0.83%

Retirement planning

Answer: b MEDIUM/HARD

59. It is now January 1, 2005. Tom and Jerry are cousins who were both born on January 1, 1975. Both turned 30 today. Their grandfather gave Tom \$4,000 on his 25th birthday, January 1, 2000, putting the funds into a trust that will be paid to Tom on his 70th birthday, January 1, 2045. Each year since 2000, the grandfather put an additional \$4,000 in the account on Tom's birthday, and the grandfather's own trustee will continue making the \$4,000 payments until January 1, 2045, when a 46th and final \$4,000 contribution will be made on Tom's 70th birthday. The grandfather wants Tom to work, not to be a "trust fund baby," but he also wants to insure that Tom is well provided for in his old age.

The grandfather has until now has been disappointed with Jerry, hence has not given him anything, but they recently reconciled, and the grandfather has decided to make an equivalent provision for Jerry. He will make the first payment to a trust for Jerry today, and he has instructed his trustee to make additional annual payments each year until January 1, 2045, when the 41st and final payment will be made. If both trusts earn an annual return of 10%, how much must the grandfather put into Jerry's trust annually to enable him to receive the same amount as Tom on January 1, 2045, when they reach age 70?

- a. \$6,110
- b. \$6,492
- c. \$7,513
- d. \$5,976
- e. \$8,349

Saving to start a business

Answer: d HARD

60. After graduation, you plan to work for Mega Corporation for 10 years and then start your own business. You expect to save \$5,000 a year for the first 5 years and \$10,000 annually for the following 5 years, with the first deposit being made a year from today. The first \$10,000 will be deposited at the end of Year 5. In addition, your grandfather just gave you a \$20,000 graduation gift which you will deposit immediately. If the account earns 8% compounded annually, how much will you have when you start your business 10 years from now?
- a. \$185,976
 - b. \$116,110
 - c. \$217,513
 - d. \$144,944
 - e. \$128,349

Cash flow required to provide a given rate of return

Answer: a HARD

61. You have been offered a 7-year investment at a price of \$50,000. It will pay \$5,000 at the end of Year 1, \$10,000 at the end of Year 2, and \$15,000 at the end of Year 3, plus a fixed but currently unspecified cash flow, X, at the end of Years 4 through 7. The payer is essentially riskless, so you are sure the payments will be made, and you regard 9% as an appropriate rate of return on riskless 7-year investments. What cash flow must the investment provide at the end of each of the final 4 years, that is, what is X?
- a. \$10,158.58
 - b. \$13,431.83
 - c. \$14,764.40
 - d. \$17,843.15
 - e. \$15,119.76

Saving for college**Answer: c HARD**

62. Nathan and Stephanie are saving for their daughter's college education. Their daughter, Paige, is now 8 years old and will be entering college 10 years from now ($t = 10$). College tuition and expenses at State U. are currently \$16,000 a year and are expected to increase at a rate of 4% a year. They expect Paige to graduate in 4 years (if Paige wants to go to graduate school, she's on her own). Tuition and other costs will be due at the beginning of each school year (at $t = 10, 11, 12,$ and 13).

So far, Nathan and Stephanie have built up \$9,000 in the college savings account. Their long-run financial plan is to contribute \$3,000 a year at the beginning of each of the next five years (at $t = 0, 1, 2, 3,$ and 4). Then they plan to make 6 equal annual contributions at the end of each of the following 6 years ($t = 5, 6, 7, 8, 9,$ and 10). Their investment account is expected to earn 8%. How large must the annual payments be in the subsequent 6 years ($t = 5, 6, 7, 8, 9,$ and 10) to meet their daughter's anticipated college costs?

- a. \$2,513
- b. \$3,110
- c. \$5,758
- d. \$2,976
- e. \$4,349

Loan amortization: repayment of principal**Answer: e HARD**

63. Your company has just taken out a 1-year installment loan for \$100,000. Monthly payments on the loan will be \$8,978, due at the end of each month. What percentage of the 3rd monthly payment will go toward the repayment of principal?

- a. 91.70%
- b. 94.81%
- c. 86.79%
- d. 88.54%
- e. 89.06%

Loan amortization: interest paid**Answer: b HARD**

64. A homeowner just obtained a 30-year (360-month) mortgage for \$120,000. The mortgage has a fixed nominal annual rate of 8%, with monthly payments. What percentage of the total payments made during the first 3 months will go toward payment of interest?

- a. 94.81%
- b. 90.79%
- c. 86.79%
- d. 88.54%
- e. 91.70%

Multiple Choice: Conceptual

PV and discount rate

Answer: a EASY

65. You are analyzing the value of an investment by calculating the present value of its expected cash flows. Which of the following would cause the investment to look better?
- 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. The riskiness of the project's cash flows increases.
 - e. The total amount of cash flows remains the same, but more of the cash flows are received in the later years and less are received in the earlier years.

Time value concepts

Answer: e EASY

66. Which of the following statements is NOT CORRECT, assuming positive interest rates?
- a. A 5-year \$100 annuity due will have a higher present value than similar ordinary annuity.
 - b. A 15-year, \$100,000 mortgage will have larger monthly payments than an otherwise similar 30-year mortgage.
 - c. If an investment pays 10% interest compounded annually, its effective rate will also be 10%.
 - d. Securities A and B offer the same nominal rate of interest, but A pays interest quarterly and B pays semiannually. Investment B will have the higher present value.
 - e. An investment's nominal interest rate will always be equal to or greater than its effective annual rate.

Time value concepts

Answer: c EASY

67. A lump sum payment of \$1,000 is due at the end of 5 years. The nominal interest rate is 10%, semiannual compounding. Which of the following statements is CORRECT?
- a. The present value of the \$1,000 would be greater if interest were compounded monthly rather than semiannually.
 - b. The periodic rate is greater than 5%.
 - c. The periodic interest rate is 5%.
 - d. The present value would be greater if the lump sum were discounted back for more periods.
 - e. The PV if the \$1,000 lump sum has a higher present value than the PV of a 5-year, \$200 ordinary annuity.

Time value concepts

Answer: e EASY

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

Effective annual rate

Answer: b EASY

69. Which of the following bank accounts has the highest effective annual return?
- a. An account that pays 10% nominal interest with monthly compounding.
 - b. An account that pays 10% nominal interest with daily compounding.
 - c. An account that pays 10% nominal interest with annual compounding.
 - d. An account that pays 9% nominal interest with daily compounding.
 - e. An account that pays 9% nominal interest with monthly compounding.

Effective annual rate

Answer: d EASY

70. 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; 8.0% with monthly compounding.
 - b. Bank 2; 8.0% with annual compounding.
 - c. Bank 3; 8.0% with quarterly compounding.
 - d. Bank 4; 8.0% with daily (365-day) compounding.
 - e. Bank 5; 8.2% with annual compounding.

Quarterly compounding**Answer: e EASY**

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

Annuities**Answer: c MEDIUM**

72. 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, while the other is an annuity due. Which of the following statements is 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. The present value of the ordinary annuity exceeds the present value of the annuity due, and the future value of an ordinary annuity also exceeds the future value of the annuity due.

Amortization**Answer: e MEDIUM**

73. A \$10,000 loan is to be amortized over 5 years, with annual end-of-year payments. Given these facts, 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 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.

Amortization**Answer: b MEDIUM**

74. Which of the following statements regarding a 30-year (360-month) \$100,000 fixed-rate mortgage is CORRECT? (Ignore all taxes and transactions costs.)
- a. The remaining balance after three years will be \$100,000 less the total amount of interest paid during the first 36 months.
 - b. The proportion of the monthly payment that goes towards repayment of principal will be higher 10 years from now than it will be this year.
 - c. The monthly payment on the mortgage will steadily decline over time.
 - d. The outstanding balance gets paid off at a faster rate early in a loan's life, rather than later.
 - e. Because it is a fixed rate mortgage, the amount paid in interest per payment is constant.

Amortization**Answer: a MEDIUM**

75. Which of the following statements regarding a 30-year, \$100,000 mortgage with a nominal interest rate of 10%, compounded monthly, is NOT CORRECT?
- a. The monthly payments will decline over time.
 - b. The proportion of the monthly payment that represents interest will be lower for the last payment than for the first payment on the loan.
 - c. The total dollar amount of principal being paid off each month gets larger as the loan approaches maturity.
 - d. The amount paid toward interest in the first payment would be lower if the nominal interest rate were 8%.
 - e. Over 90% of the first payment goes toward interest.

Time value concepts

Answer: d MEDIUM

76. Which of the following is NOT CORRECT?
- a. The present value of a 5-year, \$100 annuity due will exceed the present value of a 5-year, \$100 ordinary annuity.
 - b. If a loan has a nominal rate of 10%, then the effective rate can never be less than 10%.
 - c. If there is annual compounding, then the effective, periodic, and nominal rates of interest are all the same.
 - d. An investment that compounds interest semiannually, and has a nominal rate of 10%, will have an effective rate less than 10%.
 - e. The proportion of the payment of a fully amortized loan that goes toward interest declines over time.

PART II – Questions and Problems from Prior Test Bank not used in Part I

Multiple Choice: Problems

EASY (#77 through #86)

Growth rate

Answer: d

77. 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%

Interest rate

Answer: b

78. 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%

Effect of inflation**Answer: c**

79. At an inflation rate of 9%, 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%?
- a. 12 years
 - b. 15 years
 - c. 18 years
 - d. 20 years
 - e. 23 years

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

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

Time for lump sum to grow**Answer: e**

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

Monthly loan payments**Answer: c**

82. You are considering buying a new, \$15,000 car, and you have \$2,000 to put toward a down payment. If you can negotiate a nominal annual interest rate of 10% and finance the car over 60 months, what are your monthly car payments?
- a. \$216.67
 - b. \$252.34
 - c. \$276.21
 - d. \$285.78
 - e. \$318.71

FV of an annuity**Answer: e**

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

PV of an annuity**Answer: a**

84. What is the present value of a 5-year, \$200 ordinary annuity, evaluated at 15%?
- a. \$ 670.43
 - b. \$ 842.91
 - c. \$1,169.56
 - d. \$1,348.48
 - e. \$1,522.64

PV of a perpetuity**Answer: c**

85. You can buy a perpetuity that pays \$1,000 annually, and your required rate of return on this investment is 15%. You should be 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

Required annuity payments**Answer: b**

86. If a 5-year ordinary annuity has a present value of \$1,000, and if the interest rate is 10%, what is the amount of each annuity payment?
- a. \$240.42
 - b. \$263.80
 - c. \$300.20
 - d. \$315.38
 - e. \$346.87

EASY/MEDIUM (#87 through #94)

Quarterly compounding and FV

Answer: a

87. If \$100 is placed in an account earning a nominal 4%, 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

PV of an uneven CF stream

Answer: b

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

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

If the discount rate is 8%, what is the investment's present value?

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

Effective annual rate

Answer: c

89. Bank A offers to lend a firm funds for an expansion, at a nominal rate of 8%, compounded monthly. Bank B will charge 9%, 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**

90. You recently received a no annual fee credit card offer that states that the annual percentage rate (APR) is 18% on outstanding balances. What is the effective annual interest rate? (Hint: Remember these companies bill you monthly.)
- a. 18.81%
 - b. 19.56%
 - c. 19.25%
 - d. 20.00%
 - e. 18.00%

Effective annual rate**Answer: b**

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

Effective annual rate**Answer: b**

92. Elizabeth has \$35,000 in an investment account, but she wants the account to grow to \$100,000 in 10 years without making any additional contributions to the account. What effective annual rate of interest does she need to earn on the account to meet her goal?
- a. 9.03%
 - b. 11.07%
 - c. 10.23%
 - d. 8.65%
 - e. 12.32%

Effective annual rate**Answer: a**

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

Nominal and effective rates

Answer: b

94. An investment pays you 9% 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%

MEDIUM (#95 through #122)

FV of an annuity

Answer: a

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

FV under monthly compounding

Answer: a

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

PV of an uneven CF stream

Answer: c

97. 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% 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

FV of a sum

Answer: b

98. You deposited \$1,000 in a savings account that pays 8% 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 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 annuity due

Answer: d

99. Starting on her 23rd birthday, Janet plans to start saving for her retirement. She will contribute \$1,000 to a brokerage account each year on her birthday, starting today. Her 42nd and final contribution will take place on her 64th birthday. Janet's aunt gave her \$10,000 today to get the account started. If the account has an expected annual return of 10%, how much will Janet expect to have in her account on her 65th birthday?
- a. \$ 985,704
 - b. \$1,034,489
 - c. \$1,085,274
 - d. \$1,139,038
 - e. \$1,254,041

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

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

- a. 12.6
- b. 19.0
- c. 19.9
- d. 29.4
- e. 38.9

FV of a sum**Answer: d**

101. Suppose you put \$100 into a savings account today, the account pays a nominal annual interest rate of 6%, 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 an annuity**Answer: e**

102. Your bank account pays a nominal interest rate of 6%, compounded daily. Your plan is to deposit \$500 in the account today, and deposit \$1,000 in the account at the end of each of the next three years. How much will you have in the account at the end of three years, after making your final deposit?

- a. \$2,591
- b. \$3,164
- c. \$3,500
- d. \$3,779
- e. \$3,788

FV of an annuity**Answer: c**

103. Terry Austin is 30 years old and is saving for her retirement. She plans to make 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% a year. If each contribution she makes is \$3,000, how much will be in the retirement account 35 years from now ($t = 35$)?

- a. \$894,380
- b. \$813,073
- c. \$897,380
- d. \$987,118
- e. \$978,688

FV of an annuity**Answer: d**

104. Today is your 20th birthday, and your parents just gave you \$5,000 that you plan to use to open a stock brokerage account. You plan to add \$500 to the account each year on your birthday. Your first \$500 contribution will come one year from now on your 21st birthday. Your 45th and final \$500 contribution will occur on your 65th birthday. You plan to withdraw \$5,000 from the account five years from now on your 25th birthday to take a trip to Europe. You also anticipate that you will need to withdraw \$10,000 from the account 10 years from now on your 30th birthday to take a trip to Asia. You expect that the account will have an average annual return of 12%. How much money do you anticipate that you will have in the account on your 65th birthday, following your final contribution?

- a. \$385,863
- b. \$413,028
- c. \$457,911
- d. \$505,803
- e. \$566,498

FV of annuity due**Answer: d**

105. You are saving money 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% in your investment account, how much money will you have in the account five years from now (at $t = 5$)?

- a. \$19,412
- b. \$20,856
- c. \$21,683
- d. \$23,739
- e. \$26,350

FV of annuity due**Answer: e**

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

FV under monthly compounding**Answer: e**

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

FV under monthly compounding**Answer: d**

108. Steven just deposited \$10,000 in a bank account that has a 12% nominal interest rate, 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**

109. You have \$2,000 invested in a bank account that pays a 4% nominal interest rate with daily compounding. How much money will you have in the account 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**

110. 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%. 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. What is the price of the most expensive car purchased?
- a. \$5,744.29
 - b. \$5,807.48
 - c. \$5,703.02
 - d. \$5,797.63
 - e. \$5,898.50

FV under quarterly compounding**Answer: c**

111. 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%. What is the future value of the investment after 2.5 years?
- a. \$520.61
 - b. \$541.63
 - c. \$542.07
 - d. \$543.98
 - e. \$547.49

FV under quarterly compounding**Answer: d**

112. Rachel wants to take a trip to England in 3 years, and saving to pay for the trip. Today (8/1/05) she made an initial deposit of \$1,000. Her plan is to add \$2,000 to the account one year from now (8/1/06) and another \$3,000 to the account two years from now (8/1/07). The account has a nominal interest rate of 7%, but the interest is compounded quarterly. How much will Rachel have in the account three years from today (8/1/08)?
- a. \$6,724.84
 - b. \$6,701.54
 - c. \$6,895.32
 - d. \$6,744.78
 - e. \$6,791.02

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

113. You are saving money for your first house, and you plan to make regular deposits into a brokerage account earning 14%. 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% 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

Present value**Answer: c**

114. Which of the following securities has the largest present value? Assume in all cases that the annual interest rate is 8% and that there are no taxes.

- a. A five-year ordinary annuity that pays you \$1,000 each year.
- b. A five-year zero coupon bond that has a face value of \$7,000.
- c. A preferred stock issue that pays an \$800 annual dividend in perpetuity. (Assume that the first dividend is received one year from today.)
- d. A seven-year zero coupon bond that has a face value of \$8,500.
- e. A security that pays you \$1,000 at the end of 1 year, \$2,000 at the end of 2 years, and \$3,000 at the end of 3 years.

PV under monthly compounding**Answer: b**

115. You have just bought a 10-year security that pays \$500 every six months. Another equally risky security also has a maturity of 10 years, and pays 10%, compounded monthly (that is, the nominal rate is 10%). What price should you have paid for 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**

116. An investment pays \$500 at the end of every 6 months for the next 3 years. The nominal interest rate is 12%; compounded quarterly. What is the present value of the investment?

- a. \$2,458.66
- b. \$2,444.67
- c. \$2,451.73
- d. \$2,463.33

e. \$2,437.56

PV of an annuity

Answer: a

117. A magazine subscription is running out and you can renew it by sending \$10 a year (the regular rate) or get a lifetime subscription to the magazine for \$100. Your cost of capital is 7%. 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

Value of a perpetuity

Answer: c

118. You are willing to pay \$15,625 to purchase a perpetuity that will pay you and your heirs \$1,250 each year, forever. If your required rate of return does not change, how much would you be willing to pay if this were a 20-year annual payment, ordinary annuity instead of a perpetuity?

- a. \$10,342
- b. \$11,931
- c. \$12,273
- d. \$13,922
- e. \$17,157

FV of an uneven CF stream

Answer: d

119. After graduation, you plan to work for 10 years and then visit Australia. You expect to save \$1,000 a year for the first 5 years and \$2,000 annually for the next 5 years. These savings cash flows will start in one year. In addition, your family has just given you a \$5,000 graduation gift. If your gift and all future contributions are put into an account that pays 8% compounded annually, what will your financial "stake" be when you leave for Australia 10 years from now?

- a. \$21,432
- b. \$28,393
- c. \$16,651
- d. \$31,148
- e. \$20,000

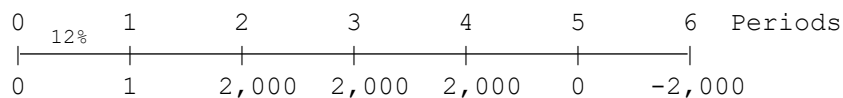
FV of an uneven CF stream**Answer: c**

120. Erika just put \$10,000 into a new savings account, and she plans to contribute another \$20,000 one year from now, and \$50,000 two years from now. The savings account pays 6% annual interest. With no other deposits or withdrawals, how much will she have in the account 10 years from today?

- a. \$ 8,246.00
- b. \$116,937.04
- c. \$131,390.46
- d. \$164,592.62
- e. \$190,297.04

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

121. What is the present value of the following cash flows, if the discount rate is 12%?



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

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

122. A 3-year project 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		

If the interest rate is 8%, what is the *expected* present value of the project? (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

MEDIUM/HARD (#123 through #155)

Value of missing payments

Answer: d

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

Effective annual rate

Answer: b

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

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

Effective annual rate

Answer: c

125. 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%

EAR and FV of an annuity**Answer: d**

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

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

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

Remaining loan balance**Answer: a**

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

Remaining mortgage balance**Answer: c**

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

Remaining mortgage balance**Answer: d**

130. You just bought a house and have a \$150,000 mortgage. The mortgage is for 30 years and has a nominal rate of 8% (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

Amortization**Answer: c**

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

Required annuity payments**Answer: c**

132. A baseball player is offered a 5-year contract that pays him the following amounts at the end of each year:

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

Instead of accepting the contract, the baseball player asks his agent to negotiate a contract that has a present value of \$1 million more than the present value of 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%. If the team were to agree to the player's terms, what would be the player's annual salary (in millions of dollars)?

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

Required annuity payments**Answer: b**

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

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

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

Required annuity payments**Answer: c**

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

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

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

Required annuity payments**Answer: a**

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

- a. \$10,145
- b. \$10,415
- c. \$10,700
- d. \$10,870
- e. \$11,160

Monthly vs. quarterly compounding**Answer: c**

136. The First National Bank offers a 5% nominal interest rate, compounded monthly on its savings accounts, while the Second National Bank offers the same effective annual return, but interest is compounded quarterly. What nominal rate does the Second National Bank offer on its savings accounts?

- a. 5.12%
- b. 5.00%
- c. 5.02%
- d. 1.28%
- e. 5.22%

Effective annual rate**Answer: d**

137. Steaks Galore needs capital for its expansion program. One bank will lend the required \$1,000,000 if Steaks Galore agrees to pay interest each quarter and repay the principal at the end of the year. The quoted rate is 10%. A second lender offers 9%, 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%

Amortization**Answer: c**

138. You are buying a factory for \$250,000 by paying 20% as a down payment, while the rest of the balance will be paid off over 30 years at a 12% interest rate. What are the 30 equal annual payments?
- a. \$20,593
 - b. \$31,036
 - c. \$24,829
 - d. \$50,212
 - e. \$ 6,667

Amortization: repayment of principal**Answer: a**

139. 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: interest paid**Answer: c**

140. 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%, with monthly payments. What percentage of the total payments made the first two years will go toward payment of interest?
- a. 89.30%
 - b. 91.70%
 - c. 92.59%
 - d. 93.65%
 - e. 94.76%

Amortization: repayment of principal**Answer: e**

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

Amortization: remaining loan balance**Answer: b**

142. The Bunker Family recently entered into a 30-year mortgage for \$300,000, with an 8% nominal interest rate. Interest is compounded monthly, and all payments are due at the end of the month. What will be the remaining balance on the mortgage after five years?

- a. \$ 14,790.43
- b. \$285,209.57
- c. \$300,000.00
- d. \$366,177.71
- e. \$298,980.02

Amortization: remaining loan balance**Answer: d**

143. Recently, Jamie and Jake each bought new cars. Both received a loan from a local bank with a nominal interest rate of 12% where payments are made at the end of each month, and they both pay the same monthly payment. Jamie's loan is for \$15,000; however, his loan matures at the end of 4 years (48 months), while Jake's loan matures in 5 years (60 months). After 48 months Jamie's loan will be paid off, but what will be the remaining balance on Jake's loan?

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

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

144. Your lease calls for payments of \$500 at the end of each month for the next 12 months. Now your landlord offers you a new 1-year lease that calls for zero rent for 3 months, then rental payments of \$700 at the end of each month for the next 9 months. You keep your money in a bank time deposit that pays a nominal annual rate of 5%. 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 of an annuity**Answer: c**

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

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

FV of annuity due**Answer: a**

146. To save money for a new house, you begin contributing money to a brokerage account. You plan to make ten \$1,500 contributions to the brokerage account at the beginning of each of the next 10 years, starting today ($t = 0$) and ending in nine years ($t = 9$). Assume that the brokerage account pays a 9% 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

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

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

<u>Year</u>	<u>Cash Flow</u>
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

EAR and FV of annuity**Answer: c**

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

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

FV of investment account**Answer: b**

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

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

College costs per child will be as follows:

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

Kelly and Brian plan to retire 40 years from now at age 65 (at $t = 40$). They plan to contribute \$12,000 per year at the end of each year for the next 40 years into an investment account that earns 10% 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

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

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

- a. \$ 528.21
- b. \$1,329.00
- c. \$ 792.49
- d. \$1,046.41
- e. \$ 875.18

PV of an uneven CF stream

Answer: d

151. 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% 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%, annual compounding. Hillary wants a health care plan that covers the fully inflated cost of health care for a student for 4 years, during Years 19 through 22 (with payments made at the end of Years 19 through 22). How much would the government have to set aside now (when a child is born), to supplement the average parent's share of a child's college health care cost? The lump sum the government sets aside will also be invested at 6%, annual compounding.

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

Required annuity payments

Answer: b

152. 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% per year. All college costs are paid at the beginning of the year. You assume that each child will be in college for four years.

You currently have \$50,000 in your educational fund. Your plan is to contribute a fixed amount to the fund over each of the next 5 years. Your first contribution will come at the end of this year, and your final contribution will come at the date when you make the first tuition payment for your oldest child. You expect to invest your contributions into various investments, which are expected to earn 8% 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**

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

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

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

Required annuity payments**Answer: c**

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

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

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

Required annuity payments**Answer: c**

155. 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%, and the current price (present value) of the security is \$360.39. Given this information, what is the equal annual payment to be received from Year 24 through Year 40 (for 17 years)?

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

HARD (#156 through #169)**Required annuity payments****Answer: a**

156. 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% 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%. How large of an annual payment do they have to make in the subsequent six years ($t = 5, 6, 7, 8, 9,$ and 10) in order to meet their child's anticipated college costs?

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

Required annuity payments**Answer: a**

157. 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% a year.

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

Required annuity payments**Answer: c**

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

John wants to close the account today and move the money to a stock fund that is expected to earn an effective return of 12% 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**

159. 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% each year. Their children, David and Daniel, just turned 2 and 3 years old today, September 1, 2002. They are expected to begin college the year in which they turn 18 years old and each will complete his schooling in four years. College tuition must be paid at the beginning of each school year.

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

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

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

Required annuity payments**Answer: b**

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

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

Required annuity payments**Answer: e**

161. Suppose you are deciding whether to buy or lease a car. If you buy the car, it will cost \$17,000 today ($t = 0$). You expect to sell the car four years (48 months) from now for \$6,000 (at $t = 48$). As an alternative to buying the car, you can lease the car for 48 months. All lease payments would be made at the end of the month. The first lease payment would occur next month ($t = 1$) and the final lease payment would occur 48 months from now ($t = 48$). If you buy the car, you would do so with cash, so there is no need to consider financing. If you lease the car, there is no option to buy it at the end of the contract. Assume that there are no taxes, and that the operating costs are the same regardless of whether you buy or lease the car. Assume that all cash flows are discounted at a nominal annual rate of 12%, so the monthly periodic rate is 1%. What is the breakeven lease payment? (That is, at what monthly payment would you be indifferent between buying and leasing the car?)
- a. \$333.00
 - b. \$336.62
 - c. \$339.22
 - d. \$343.51
 - e. \$349.67

Required annuity payments**Answer: c**

162. Today is Craig's 24th birthday, and he wants to begin saving for retirement. To get started, his plan is to open a brokerage account, and to put \$1,000 into the account today. Craig intends to deposit \$X into the account each year on his subsequent birthdays until the age of 64. In other words, Craig plans to make 40 contributions of \$X. The first contribution will be made one year from now on his 25th birthday, and the 40th (and final) contribution will occur on his 64th birthday. Craig plans to retire at age 65 and he expects to live until age 85. Once he retires, Craig estimates that he will need to withdraw \$100,000 from the account each year on his birthday in order to meet his expenses. (That is, Craig plans to make 20 withdrawals of \$100,000 each--the first withdrawal will occur on his 65th birthday and the final one will occur on his 84th birthday.) Craig expects to earn 9% a year in his brokerage account. Given his plans, how much does he need to deposit into the account for each of the next 40 years, in order to reach his goal? (That is, what is \$X?)
- a. \$2,379.20
 - b. \$2,555.92
 - c. \$2,608.73
 - d. \$2,657.18
 - e. \$2,786.98

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

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

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

Amortization**Answer: b**

164. 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%, and has annual payments. In addition, the Association must set up a reserve to pay off the loan by making 20 equal annual payments into an account that pays 8%, annual compounding. The interest-accumulated amount in the reserve will be used to retire the entire issue at its maturity 20 years hence. The Association plans to meet the payment requirements by selling season tickets at a \$10 net profit per ticket. How many tickets must be sold each year to service the debt (to meet the interest and principal repayment requirements)?

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

Effective annual rate**Answer: c**

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

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

PMT and quarterly compounding**Answer: b**

166. 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%, 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

Value of unknown withdrawal**Answer: d**

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

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

e. \$13,879.52

Non-annual compounding

Answer: a

168. 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% 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% 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% each quarter. The money is to be deposited in an account paying a 12% nominal annual rate, but compounded quarterly (to be left on deposit for the entire 2-year period).

Which one would you choose?

- a. Choice 1
- b. Choice 2
- c. Choice 3
- d. Either one, since they all have the same present value.
- e. Neither one, since they all have negative present values.

Breakeven annuity payment

Answer: a

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

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

Multiple Part:

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

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

Required mortgage payment

Answer: b

170. What is the monthly payment on the mortgage?

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

Remaining mortgage balance

Answer: e

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

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

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

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

Time to accumulate a lump sum

Answer: d

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

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

Required annual rate of return

Answer: c

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

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

e. 12.91%

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

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

Monthly mortgage payments

Answer: c

174. What is the monthly payment on the mortgage?

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

Amortization

Answer: d

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

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

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

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

Monthly mortgage payments

Answer: d

176. What is the monthly payment on the mortgage?

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

Remaining mortgage balance

Answer: c

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

- a. \$152,879.31
- b. \$155,362.50
- c. \$158,937.91

- d. \$160,245.39
- e. \$160,856.84

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

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

Amortization

Answer: d

178. What percentage of their monthly payments the first year will go towards interest payments?

- a. 7.76%
- b. 9.49%
- c. 82.17%
- d. 90.51%
- e. 91.31%

Amortization

Answer: a

179. If Victoria and David were able to refinance their mortgage and replace it with a 7% nominal annual interest rate, how much (in dollars) would their monthly payment decline?

- a. \$ 51.35
- b. \$ 59.78
- c. \$ 72.61
- d. \$ 88.37
- e. \$104.49

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

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

Monthly mortgage payment

Answer: c

180. What is the monthly payment on the mortgage?

- a. \$1,759.41
- b. \$1,833.33
- c. \$2,036.36
- d. \$2,055.29
- e. \$3,105.25

Amortization

Answer: b

181. What percentage of the total payments the first year (the first twelve months) will go towards repayment of principal?

- a. 11.88%
- b. 12.00%

- c. 13.21%
- d. 13.55%
- e. 14.16%

Web Appendix 2A

Multiple Choice: Problems

PV continuous compounding

Answer: b EASY/MEDIUM

2A-1. In six years' time, you are scheduled to receive money from a trust established by your grandparents. When the trust matures there will be \$100,000 in the account. If the account earns 9% compounded continuously, how much is in the account today?

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

FV continuous compounding

Answer: a MEDIUM

2A-2. Assume one bank offers you a nominal annual interest rate of 6% compounded daily while another bank offers you continuous compounding at a 5.9% 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 compounding

Answer: b MEDIUM

2A-3. You have \$5,438 in an account that pays 10% interest, compounded continuously. If you deposited some funds 10 years ago, how much was your original deposit?

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

Continuous compounded interest rate

Answer: a MEDIUM/HARD

2A-4. In order to purchase your first home you need a down payment of \$19,000 four years from today. You currently have \$14,014 to invest. In order to achieve your goal, what nominal interest rate, compounded continuously, must you earn on this investment?

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

Payment and continuous compounding

Answer: d MEDIUM/HARD

2A-5. You place \$1,000 in an account that pays 7% interest compounded continuously. You plan to hold the account exactly three years. Simultaneously, in another account you deposit money that earns 8% 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% interest compounded semiannually?

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

Continuous compounding

Answer: d MEDIUM/HARD

2A-6. For a 10-year deposit, what annual rate payable semiannually will produce the same effective rate as 4% compounded continuously?

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

Continuous compounding

Answer: b MEDIUM/HARD

2A-7. 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%?

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

Continuous compounding

Answer: b HARD

2A-8. If you receive \$15,000 today and can invest it at a 5% 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. FV of a lump sum Answer: a EASY

N	5
I/YR	10%
PV	-\$100
PMT	\$0
FV	\$161.05

2. FV of a lump sum Answer: c EASY

N	3
I/YR	4%
PV	-\$2,000
PMT	\$0
FV	\$2,249.73

3. FV of a lump sum Answer: e EASY

N	10
I/YR	8%
PV	-\$100.00
PMT	\$0.00
FV	\$215.89

4. FV of a lump sum Answer: b EASY

N	100
I/YR	5%
PV	-\$1.00
PMT	\$0.00
FV	\$131.50

5. PV of a lump sum Answer: d EASY

N	3
I/YR	6%
PV	\$1,888.92
PMT	\$0
FV	-2,249.73

6. PV of a lump sum

Answer: a EASY

N	100
I/YR	10%
PV	\$0.73
PMT	\$0
FV	-\$10,000

7. PV of a lump sum

Answer: c EASY

N	3
I/YR	4%
PV	\$889.00
PMT	\$0
FV	-\$1,000.00

8. Interest rate on a simple lump sum investment

Answer: e EASY

N	10
I/YR	5.00%
PV	-\$613.81
PMT	\$0
FV	\$1,000.00

9. Simple growth rate

Answer: b EASY

N	5
I/YR	14.87%
PV	-\$1.00
PMT	\$0
FV	\$2.00

10. Number of periods

Answer: e EASY

N	14.21
I/YR	5.00%
PV	-\$100.00
PMT	\$0
FV	\$200.00

11. Number of periods

Answer: a EASY

N	6.64
I/YR	11.00%
PV	-\$2.00
PMT	\$0
FV	\$4.00

12. FV of an ordinary annuity

Answer: c EASY

N	5
I/YR	6.00%
PV	\$0.00
PMT	-\$3,000
FV	\$16,911.28

13. FV of an ordinary annuity

Answer: e EASY

N	3
I/YR	9.00%
PV	\$0.00
PMT	-\$5,000
FV	\$16,390.50

14. FV of an annuity due

Answer: b EASY

BGN mode

N	5
I/YR	6.00%
PV	\$0.00
PMT	-\$3,000
FV	\$17,925.96

15. FV of an annuity due

Answer: d EASY

BGN mode

N	3
I/YR	9.00%
PV	\$0.00
PMT	-\$5,000
FV	\$17,865.65

16. PV of an ordinary annuity

Answer: a EASY

N	5
I/YR	5.00%
PV	\$12,988.43
PMT	-\$3,000
FV	\$0.00

17. PV of an ordinary annuity

Answer: c EASY

N	5
I/YR	6.00%
PV	\$4,212.36
PMT	-\$1,000
FV	\$0.00

18. PV of an ordinary annuity

Answer: e EASY

N	20
I/YR	6.00%
PV	\$573,496.06
PMT	-\$50,000
FV	\$0.00

19. PV of an annuity due

Answer: b EASY

BGN mode

N	5
I/YR	5.00%
PV	\$13,637.85
PMT	-\$3,000
FV	\$0.00

20. PV of an annuity due

Answer: d EASY

BGN mode

N	5
I/YR	6.00%
PV	\$4,465.11
PMT	-\$1,000
FV	\$0.00

21. PV of an annuity due

Answer: a EASY

BGN mode

N	20
I/YR	6.00%
PV	\$607,905.82
PMT	-\$50,000
FV	\$0.00

22. Payments on an ordinary annuity

Answer: c EASY

N	15
I/YR	6.00%
PV	-\$200,000
PMT	\$20,592.55
FV	\$0.00

23. Payments on an ordinary annuity

Answer: e EASY

N	20
I/YR	8.00%
PV	-\$500,000
PMT	\$50,926.10
FV	\$0.00

24. Payments on an annuity due

Answer: b EASY

BGN mode

N	20
I/YR	8.00%
PV	-\$500,000
PMT	\$47,153.80
FV	\$0.00

25. Payments on an annuity due

Answer: d EASY

BGN mode

N	15
I/YR	6.00%
PV	-\$200,000
PMT	\$19,426.94
FV	\$0.00

26. Years to deplete an ordinary annuity

Answer: a EASY

N	20.91
I/YR	8.00%
PV	-\$500,000
PMT	\$50,000.00
FV	\$0.00

27. Years to deplete an annuity due

Answer: c EASY

BGN mode

N	17.54
I/YR	8.00%
PV	-\$500,000
PMT	\$50,000.00
FV	\$0.00

28. Interest rate implicit in an annuity

Answer: e EASY

N	20
I/YR	4.22%
PV	-\$1,000,000
PMT	\$75,000
FV	\$0.00

29. Interest rate implicit in an annuity

Answer: b EASY

BGN mode

N	30
I/YR	3.08%
PV	-\$10,000,000
PMT	\$500,000
FV	\$0.00

30. Interest rate implicit in an annuity

Answer: d EASY

BGN mode

N	10
I/YR	24.63%
PV	-\$45,000
PMT	\$10,000
FV	\$0.00

31. PV of an annuity due

Answer: a EASY

BGN mode

N	8
I/YR	7.00%
PV	\$159,732
PMT	-\$25,000
FV	\$0.00

32. PV of an ordinary annuity plus an ending payment

Answer: c EASY

N	6
I/YR	6.00%
PV	\$5,974.77
PMT	\$1,000
FV	\$1,500

33. PV of a perpetuity

Answer: e EASY

I/YR	6.00%
PMT	\$100
PV	\$1,666.67

Divide PMT by I.

34. Rate of return on a perpetuity

Answer: b EASY

Cost (PV)	\$1,500	
PMT	\$105	
I/YR	7.00%	Divide PMT by Cost.

35. Dollar payments on a perpetuity Answer: d EASY

Cost (PV)	\$1,500	
I/YR	8.00%	
PMT	\$120.00	Multiply Cost by I.

36. PV of an uneven cash flow stream Answer: a EASY

I/YR =	8%				
	0	1	2	3	4
CFs:	\$0	\$100	\$300	\$0	\$500
PV of CFs:	\$0	\$92.59	\$257.20	\$0	\$367.51
PV =	\$717.31	Find the individual PVs and sum them.			
PV =	\$717.31	Automate the process using Excel or a calculator, by inputting the data into the cash flow register and pressing the NPV key.			

37. PV of an uneven cash flow stream Answer: c EASY/MEDIUM

I/YR =	5%			
	0	1	2	3
CFs:	\$1,000	\$2,000	\$3,000	\$5,000
PV of CFs:	\$1,000	\$1,904.76	\$2,721.09	\$4,319.19
PV =	\$9,945.04	Found by summing individual PVs.		
PV =	\$9,945.04	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.

38. FV of a lump sum, semiannually Answer: e EASY/MEDIUM

Years	3	N = Periods = years x periods/yr =	6
Periods/Yr	2		
PMT	\$0		
Nom. I/YR	8.00%	I/Period = Nom. I/Periods per year =	4.00%
PV	\$2,000		
FV	\$2,530.64	Could be found using a calculator, the equation, or Excel. Note that we must first convert to periods and rate per period.	

39. PV of a lump sum, semiannually Answer: b EASY/MEDIUM

Years	3	N = Periods = years x periods/yr =	6
Periods/Yr	2		
PMT	\$0		
Nom. I/YR	8.00%	I/Period = Nom. I/Periods per year =	4.00%
FV	\$2,000		
PV	\$1,580.63	Could be found using a calculator, the equation, or Excel. Note that we must first convert to periods and rate per period.	

40. **FV of an uneven cash flow stream** **Answer: d MEDIUM**

I/YR =	8%				
	0	1	2	3	4
CFs:	\$0	\$100	\$300	\$0	\$500
FV of CFs:	\$0	\$126	\$350	\$0	\$500
FV =	\$975.89	Found by summing individual PVs.			
FV =	\$975.89	Found with the NFV key in some calculators.			
FV =	\$975.89	Found with a calculator by first finding the PV of the stream, then finding the FV of that PV.			
			PV of the stream:	\$717.31	
			FV of the PV:	\$975.89	

41. **Interest rate built into an uneven cash flow stream** **Answer: a MEDIUM**

	0	1	2	3	4	5
CFs:	-\$1,000	\$50	\$50	\$50	\$50	\$1,050
I/YR	5.0%	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.				

42. **Interest rate built into an uneven cash flow stream** **Answer: c MEDIUM**

	0	1	2	3	4
CFs:	-\$500	\$50	\$60	\$70	\$516
I/YR	10.0%	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.			

43. **FV of a lump sum, monthly** **Answer: e MEDIUM**

Years	3	N = Periods = years x periods/yr =	36
Periods/Yr	12		
PMT	\$0		
Nom. I/YR	8.00%	I/Period = Nom. I/Periods per year =	0.67%
PV	\$2,000		
FV	\$2,540.47	Could be found using a calculator, the equation, or Excel. Note that we must first convert to periods and rate per period.	

44. PV of a lump sum, monthly Answer: b MEDIUM

Years	3	$N = \text{Periods} = \text{years} \times \text{periods/yr} =$	36
Periods/Yr	12		
PMT	\$0		
Nom. I/YR	8.00%	$I/\text{Period} = \text{Nom. I}/\text{Periods per year} =$	0.67%
FV	\$2,000		
PV	\$1,574.51		

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

45. APR vs. effective annual rate Answer: d MEDIUM

APR	15%
Periods/yr	12
EFF%	16.08%

46. Nominal vs. effective annual rate Answer: a MEDIUM

Nominal I/YR	6%
Periods/yr	12
EFF%	6.17%

47. Interest charges, simple interest Answer: c MEDIUM

Nominal I/YR	8%	Days in month	30
Days/yr	360	Daily rate	0.0222%
Amount borrowed	\$10,000	Interest per day	\$2.22
Interest per month	\$66.67		

48. Fractional time periods Answer: e MEDIUM

Nominal I/YR	6%	Rate/day	0.0167%
Number of months	7	Days on deposit	210
Days in year	360		
Days in month	30		
Amount deposited	\$5,000		
Ending amount	\$5,178.08		

49. Loan amortization: payment Answer: b MEDIUM

I/YR	8%
Years	4
Amount borrowed	\$25,000
Payments	\$7,548.02

Found with a calculator, as the PMT.

50. Loan amortization: interest Answer: d MEDIUM

I/YR	8%
Years	4
Amount borrowed	\$25,000
Interest in Year 1	\$2,000.00

Multiply the rate times the amt borrowed.

51. Comparing the effective cost of two bank loans Answer: a 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 applied the formula using Excel.

Nominal rate, Bank A	7%
Nominal rate, Bank B	8%
Periods/yr, A	12
Periods/yr, B	1
EFF% A	7.23%
EFF% B	8.00%
Difference	0.77%

52. Mortgage payments Answer: c MEDIUM

N	360
I	0.5833%
PV	\$190,000
PMT	-\$1,264
FV	\$0.00

53. Loan amortization: principal repayment Answer: e MEDIUM/HARD

Interest rate	8%
Years	4
Amount borrowed	\$25,000
Step 1: Find the PMT	\$7,548
Step 2: Find the 1st year's interest	\$2,000
Step 3: Subtract the interest from the payment; this is repayment of principal	\$5,548

54. Loan amortization: ending balance Answer: b MEDIUM/HARD

Interest rate	8%
Years	4
Amount borrowed	\$25,000
Step 1: Find the PMT	\$7,548
Step 2: Find the 1st year's interest	\$2,000
Step 3: Subtract the interest from the payment; this is repayment of principal	\$5,548
Step 4: Subtract the repayment of principal from the beginning amount owed	\$19,452

55. **Retirement planning** **Answer: d MEDIUM/HARD**

Interest rate	10%
Years to retirement	35
Years in retirement	30
Amount saved per year	\$3,000
Step 1: Find the amount at age 65; use the FV function	\$813,073
Step 2: Find the PMT for a 30 year ordinary annuity using that FV as the PV	\$86,250

56. **Non-annual compounding** **Answer: a MEDIUM/HARD**

Interest rate	12%			
Periods/year	12	Years on	Months on	Ending
Monthly rate	1.00%	deposit:	deposit:	Amount
1st deposit	\$5,000	3	36	\$7,153.84
2nd deposit	\$10,000	2	24	\$12,697.35
3rd deposit	\$15,000	1	12	\$16,902.38
				\$36,753.57

57. **Lifetime subscription vs. annual payments** **Answer: c 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	7%
Annual cost	\$100
Lifetime subscription cost	-\$1,000
Number of payments made	15.70 rounded to 16

Recall, we used BEGIN mode (because it is an annuity due), so it takes 16 payments before the lifetime subscription is better. Since the 1st payment occurs today, the 16th payment occurs at $t = 15$ (15 years from now). So, you must live for: $16 - 1 = \underline{15 \text{ years}}$.

58. **Comparing the effective cost of two bank loans** **Answer: e MEDIUM/HARD**

Students must understand that "simple interest with interest paid monthly" means that the bank gets the interest at the end of each month, 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%, monthly compounding." The problem can be worked most easily using the interest conversion feature of a calculator. It could also be worked using the conversion formula. We applied the formula using Excel.

Nominal rate, Bank A	6%
Nominal rate, Bank B	7%
Periods/yr, A	12
Periods/yr, B	1
EFF% A	6.17%
EFF% B	7.00%
Difference	0.83%

59. Retirement planning Answer: b MEDIUM/HARD

Tom's retirement account		Jerry's retirement account	
N	46	N	41
I/YR	10%	I/YR	10%
PV	\$0	PV	\$0
PMT	\$4,000	PMT	\$6,492
FV	\$3,167,181	FV	\$3,167,181

= on 70th b-day, accounts must equal =

60. Saving to start a business Answer: d HARD

There are 3 cash flow streams: the gift and the two annuities. The gift will grow for 10 years. Then there is a 5-year annuity that will compound for an additional 5 years. Finally, there is a second 5-year annuity. The sum of the compounded values of those three sets of cash flows is the final amount.

Nominal interest rate	8%	Year 5	Year 10
Gift	\$20,000	NA	\$43,178
1st annuity	\$5,000	\$29,333	\$43,100
2nd annuity	\$10,000	NA	\$58,666
Total years	10		
Annuity years	5		
		Final amt:	\$144,944

61. Cash flow required to provide a given rate of return Answer: a HARD

This is a very difficult problem. It would not generally be appropriate for a regular in-class exam. It would be better for a take-home exam. We must find a value of X such that the PV of the positive CFs, discounted at 9%, will equal the initial negative CF.

The problem is relatively easy with Excel but quite hard with a calculator because it's hard to conceptualize the required setup and steps.

Excel solution: Set the problem up as shown below. Put a guess--we initially guessed \$10,000--in the boxed cell under the first X. The IRR initially is less than 9%, so raise the guess, and keep iterating until IRR = 9%. This value of X is the required payment for the investment to provide the 9% rate of return. The problem can be worked faster if you know how to use Goal Seek; then you tell Excel to change the X cell to the value that causes IRR = 9%. It turns out to be exactly:

I/YR =	9%							
	0	1	2	3	4	5	6	7
	-\$50,000	\$5,000	\$10,000	\$15,000	X	X	X	X
	-\$50,000	\$5,000	\$10,000	\$15,000	\$10,000	\$10,000	\$10,000	\$10,000
IRR =	8.78%							

Calculator solution:

- Step 1: Use CF register to find the PV of the 4 known cash flows at the end of Year 3. -\$25,413.29
- Step 2: Now find the FV at the end of Period 3, i.e., compound PV for 3 years. -\$32,910.95
- Step 3: Now find the PMT for a 4-year annuity with the PV. **\$10,158.58**

62. Saving for college

Answer: c HARD

Current college costs	\$16,000
College cost inflation	4%
Account return	8%
First 5 payments	\$3,000
Current account balance	\$9,000

First, determine each year of college's costs.

Year 1 of college (t = 10)	=	\$23,684
Year 2 of college (t = 11)	=	\$24,631
Year 3 of college (t = 12)	=	\$25,617
Year 4 of college (t = 13)	=	\$26,641

The PV (at t = 10) of all of these college costs is: **\$89,601** This is what they need at t = 10.

After the first 5 payments, the college account will have (at t=4): \$29,844.20

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

N	6
I	8%
PV	-\$29,844
PMT	-\$5,758
FV	\$89,601.29

63. Loan amortization: repayment of principal

Answer: e HARD

N	12
I	1.17%
PV	\$100,000
PMT	\$8,978
FV	\$0

% paid toward prin. = 89.06%

Amortization schedule(first 4 years)

Year	Beg. Balance	Payment	Interest	Principal	End. Balance
1	\$100,000.00	\$8,978	\$1,165.41	\$7,812.59	\$92,187.41
2	\$92,187.41	\$8,978	\$1,074.36	\$7,903.64	\$84,283.76
3	\$84,283.76	\$8,978	\$982.25	\$7,995.75	\$76,288.01
4	\$76,288.01	\$8,978	\$889.07	\$8,088.93	\$68,199.08

64. Loan amortization: interest paid

Answer: b HARD

N	360		
I	0.67%	Paid toward interest	\$2,398
PV	\$120,000	Total payments	\$2,642
PMT	\$881	% Paid toward interest	90.79%
FV	\$0		

Amortization schedule(first 3 months)

Year	Beg. Balance	Payment	Interest	Principal	End. Balance
1	\$120,000.00	\$880.52	\$800.00	\$80.52	\$119,919.48
2	\$119,919.48	\$880.52	\$799.46	\$81.05	\$119,838.43
3	\$119,838.43	\$880.52	\$798.92	\$81.59	\$119,756.84
	Total payments:	\$2,641.55	\$2,398.39	\$243.17	

65. **PV and discount rate** **Answer: a EASY**
66. **Time value concepts** **Answer: e EASY**
67. **Time value concepts** **Answer: c EASY**

Statement a is false, because the more compoundings per year, the less the present value of a lump sum. Statement b is false and statement c is true, because the periodic rate is 5%. Statement d is false, because the more periods a lump sum is discounted, the less its present value is. Statement e is false, because the annuity has cash flows occurring sooner than the lump sum is due, so the sum of the PVs of its cash flows will be greater.

68. **Time value concepts** **Answer: e EASY**

Since the effective rates are all the same, the correct answer must be the investment that has the largest amount of money compounding for the longest time, which is statement e. This can be proven by assuming an effective annual rate and performing the calculations.

69. **Effective annual rate** **Answer: b EASY**

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

70. **Effective annual rate** **Answer: d EASY**

The investment with the highest nominal rate and most frequent compoundings will have the highest effective rate. For this reason, Bank 4 (statement d) dominates Banks 1-3 (statements a, b, and c). Therefore, Bank 4's effective rate (8.328%) must be calculated and compared to Bank 5's effective rate (8.2%). Therefore, statement d is the correct choice.

71. **Quarterly compounding** **Answer: e EASY**

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

72. **Annuities** **Answer: c MEDIUM**

Statement a is false, because the present value of an annuity due (all else equal) is greater than the present value of an ordinary annuity, since cash flows are received sooner and reinvested longer. Statements b and e are false, because the present and future values of an annuity due (all else equal) are also greater, since the cash flows are reinvested longer. Statement c is true for the same reasons. Statement d is false, because the difference in PVs of the two annuities will change as interest rates change.

73. **Amortization** **Answer: e MEDIUM**

Statement a is false, because the interest rate and annual payments are positively correlated (higher rates = higher payments, and vice versa). Statement b is false, because interest during Year 1 would be the interest rate times the beginning balance, which are identical in both cases. Statement c is false, because early payments in a loan's life have a lot of interest, but later payments include very little interest since the balance is low at this point. Statement d is false, because this composition changes with each payment, as more principal and less interest is paid with each payment. Statement e is true, because if the interest rate is higher, then a greater proportion of total payments (and hence, each individual payment) goes toward interest.

74. **Amortization** **Answer: b MEDIUM**

Statement a is false, because the remaining balance will be the loan amount less the amount paid toward principal. Statement b is true, because the percentage paid toward principal increases throughout the loan's life. Statement c is false, because the payment will be same each month. Statement d is false, because the balance gets paid off quicker at the end of a bond's life when the balance is lower and more of the payment goes toward principal. Statement e is false, because fixed-rate means that the interest rate applied to the outstanding balance (which does change) will be fixed.

75. **Amortization** **Answer: a MEDIUM**

Statement a is false, because monthly payments will not decline over time, they will stay the same. Statement b is true, because the percentage paid toward interest declines over time. Statement c is true, because interest due for every payment gets progressively smaller, which means that the portion toward principal gets larger. Statement d is true, because if the interest rate is lower, less is paid toward interest. Statement e is

true. Therefore, answer choice a is the correct answer.

76. **Time value concepts**

Answer: d MEDIUM

77. **Growth rate**

Answer: d

Time Line:



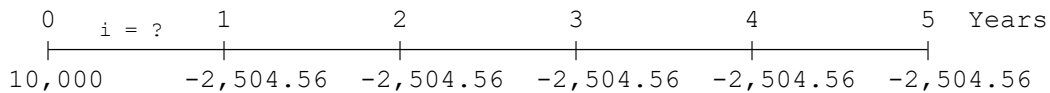
Financial calculator solution:

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

78. **Interest rate**

Answer: b

Time Line:



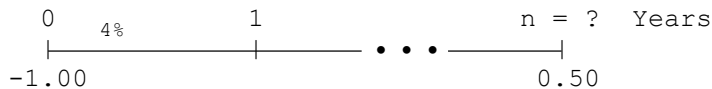
Financial calculator solution:

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

79. **Effect of inflation**

Answer: c

Time Line:



Financial calculator solution:

Inputs: $I/YR = 4$; $PV = -1$; $PMT = 0$; $FV = 0.50$.
Output: $N = -17.67 \approx 18$ years.

80. **Time for a sum to double**

Answer: d

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

81. **Time for lump sum to grow**

Answer: e

Financial calculator solution:

Inputs: $I/YR = 10$; $PV = -300000$; $PMT = 0$; $FV = 1000000$. Outputs: $N = 12.63$ years.

82. **Monthly loan payments**

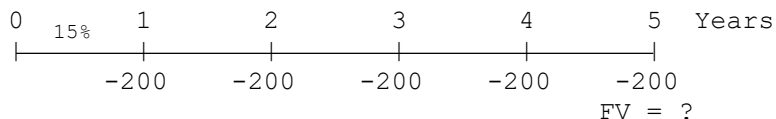
Answer: c

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

83. **FV of an annuity**

Answer: e

Time Line:



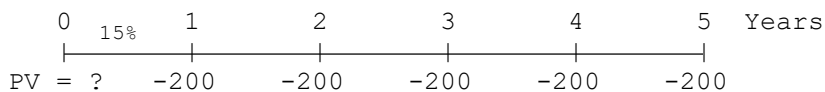
Financial calculator solution:

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

84. **PV of an annuity**

Answer: a

Time Line:



Financial calculator solution:

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

85. **PV of a perpetuity**

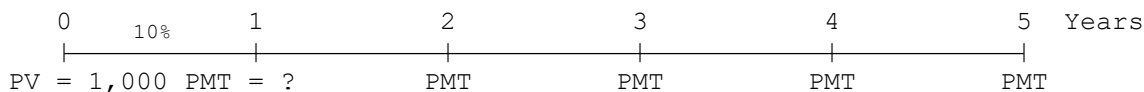
Answer: c

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

86. **Required annuity payments**

Answer: b

Time line:



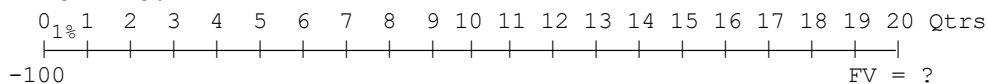
Financial calculator solution:

Inputs: N = 5; I/YR = 10; PV = -1000; FV = 0. Output: PMT = \$263.80.

87. **Quarterly compounding and FV**

Answer: a

Time line:



Financial calculator solution:

Inputs: N = 20; I/YR = 1; PV = -100; PMT = 0. Output: FV = \$122.02.

88. **PV of an uneven CF stream**

Answer: b

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

Financial calculator solution (using the cash flow register):

Inputs: $CF_0 = 0$; $CF_1 = 10000$; $CF_2 = 25000$; $CF_3 = 50000$; $CF_4 = 35000$; I/YR = 8.

Output: NPV = \$96,110.39 \approx \$96,110.

89. Effective annual rate **Answer: c**

Bank A: 8%, monthly.

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

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

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

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

90. Effective annual rate **Answer: b**

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

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

91. Effective annual rate **Answer: b**

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

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

Therefore, the highest effective return is choice b.

92. Effective annual rate **Answer: b**

Financial calculator solution:

Inputs: $N = 10$; $PV = -35000$; $PMT = 0$; $FV = 100000$. Outputs: I/YR = 11.07%.

93. Effective annual rate **Answer: a**

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

a financial calculator.

- a. EAR = 10.2736%.
- b. EAR = 10.1846%.
- c. EAR = 10.2000%.
- d. EAR = 10.2500%.
- e. EAR = 10.0339%.

Therefore, the highest effective return is choice a.

94. Nominal and effective rates **Answer: b**

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

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

95. FV of an annuity **Answer: a**

The payments start next year, so the calculator should be in END mode.
Enter the following data in your calculator:
N = 42; I/YR = 12; PV = -1000; PMT = -2000. Output: FV = \$2,045,442.

96. FV under monthly compounding **Answer: a**

Step 1: The interest rate must match the payment period, and since the payments are monthly, you need the monthly periodic rate.
Periodic rate = $8\%/12 = 0.667\%$.

Step 2: Enter the numbers given into your financial calculator:
N = 30; I/YR = $8/12 = 0.667$; PV = 0; PMT = -200. Output: FV = \$6,617.77.

97. PV of an uneven CF stream **Answer: c**

Time Line:
0 14% 1 2 3 4 5 6 7 8 9 Years
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
PV = ? 2,000 2,000 2,000 2,000 2,000 3,000 3,000 3,000 4,000

Financial calculator solution (using the cash flow register):
Inputs: $CF_0 = 0$; $CF_1 = 2000$; $N_j = 5$; $CF_2 = 3000$; $N_j = 3$; $CF_3 = 4000$;
I/YR = 14.
Output: NPV = \$11,714.

98. FV of a sum **Answer: b**

Time Line:
0 2% 1 2 3 4 5 6 Qtrs
|-----|-----|-----|-----|-----|-----|
-1,000 FV = ?

Financial calculator solution:

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

99. FV of annuity due

Answer: d

Since payments begin today and occur every year on Janet's birthday, the calculator must be set to BEGIN mode. Now, find the future value of these payments with your financial calculator:

BEG $N = 42$; $I/YR = 10$; $PV = 10000$; $PMT = 1000$. Output: $FV = \$1,139,038$.

100. Time value of money and retirement

Answer: b

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

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

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

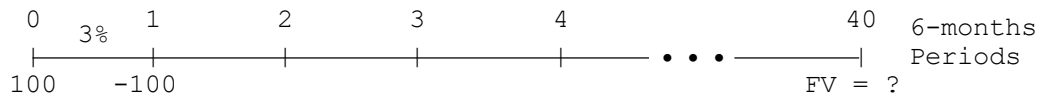
Step 2: Calculate the difference in the length of time for the accounts to reach \$1 million:

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

101. FV of a sum

Answer: d

Time Line:



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

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

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

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

102. FV of an annuity

Answer: e

Step 1: Determine the effective annual rate:

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

Using the calculator, input the following data:

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

Step 2: Determine the future value of the annuity:

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

103. FV of an annuity**Answer: c**

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

104. FV of an annuity**Answer: d**

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

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

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

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

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

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

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

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

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

105. FV of annuity due**Answer: d**

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

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

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

106. FV of annuity due**Answer: e**

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

Enter the following inputs in the calculator:

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

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

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

107. FV under monthly compounding **Answer: e**

Financial calculator solution:

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

108. FV under monthly compounding **Answer: d**

Step 1: Calculate the FV at $t = 36$ of the first deposit.

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

Step 2: Calculate the FV at $t = 36$ of the second deposit.

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

Step 3: Calculate the FV at $t = 36$ of the third deposit.

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

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

109. FV under daily compounding **Answer: a**

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

110. FV under non-annual compounding **Answer: d**

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

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

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

111. FV under quarterly compounding **Answer: c**

The effective rate is given by:

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

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

The future value is given by:

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

112. FV under quarterly compounding

Answer: d

There are several ways of solving this. One way is:
First, find the periodic (quarterly) rate of $7\%/4 = 1.75\%$.

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

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

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

113. FV of an uneven CF stream

Answer: e

First, calculate the payment amounts:

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

114. Present value

Answer: c

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

a. Enter the following inputs in your calculator:

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

b. Enter the following inputs in your calculator:

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

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

d. Enter the following inputs in your calculator:

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

e. Enter the following inputs in your calculator:

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

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

115. PV under monthly compounding

Answer: b

Start by calculating the effective rate on the second security:

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

Then, convert this effective rate to a semiannual rate:

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

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

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

116. PV under non-annual compounding

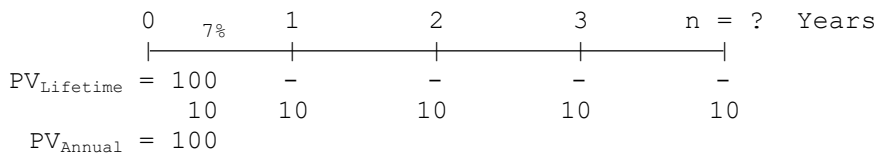
Answer: c

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

117. PV of an annuity

Answer: a

Time Line:



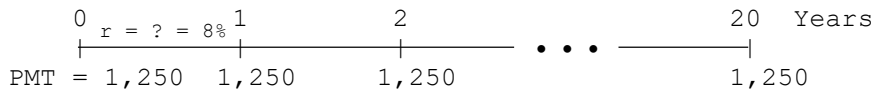
Financial calculator solution:

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

118. Value of a perpetuity

Answer: c

Time Line:



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

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

Financial calculator solution:

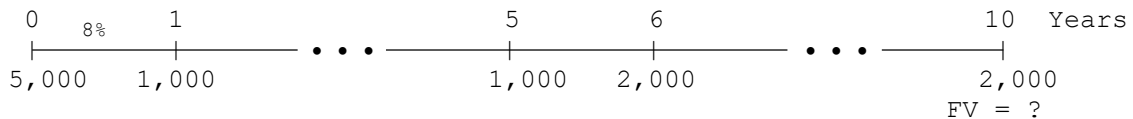
Inputs: $N = 20$; $I/YR = 8$; $PMT = -1250$; $FV = 0$.

Output: $PV = \$12,272.68 \approx \$12,273$.

119. FV of an uneven CF stream

Answer: d

Time Line:



Financial calculator solution:

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

Inputs: $CF_0 = 5000$; $CF_1 = 1000$; $N_j = 5$; $CF_2 = 2000$; $N_j = 5$; $I/YR = 8$.

Output: $NPV = \$14,427.45$.

Inputs: $N = 10$; $I/YR = 8$; $PV = -14427.45$; $PMT = 0$.

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

120. FV of an uneven CF stream

Answer: c

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

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

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

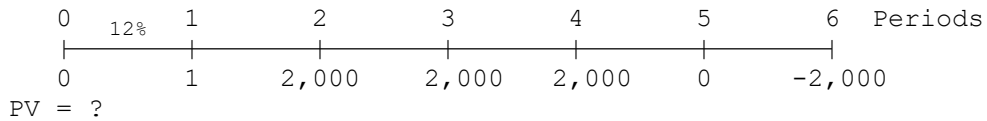
Step 2: Calculate the FV 10 years from now of the PV of the deposits:

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

121. PV of an uneven CF stream

Answer: a

Time Line:



Financial calculator solution:

Using cash flows

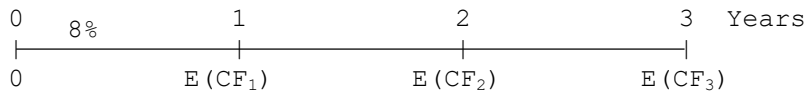
Inputs: $CF_0 = 0$; $CF_1 = 1$; $CF_2 = 2000$; $N_j = 3$; $CF_3 = 0$; $CF_4 = -2000$; I/YR = 12.

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

122. PV of uncertain cash flows

Answer: e

Time Line:



Calculate expected cash flows

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

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

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

Financial calculator solution:

Using cash flows

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

Output: NPV = \$1,347.61.

123. Value of missing payments

Answer: d

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

To do this first find the present value of them.

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

Find the FV of this present value.

$$N = 3; \text{ I/YR} = 9; \text{ PV} = -4453.15; \text{ PMT} = 0; \text{ FV} = \$5,766.96.$$

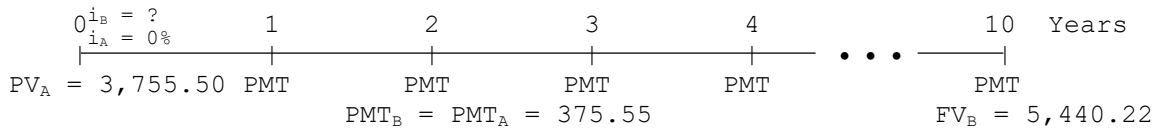
Now solve for X.

$$N = 17; \text{ I/YR} = 9; \text{ PV} = -5766.96; \text{ FV} = 0; \text{ and solve for PMT} = \$675.$$

124. Effective annual rate

Answer: b

Time Line:



Financial calculator solution:

Calculate the PMT of the annuity

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

Calculate the effective annual interest rate

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

Output: I/YR = 7.999 ≈ 8.0%.

125. Effective annual rate

Answer: c

Your proposal:

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

$$EAR_1 = 12\%.$$

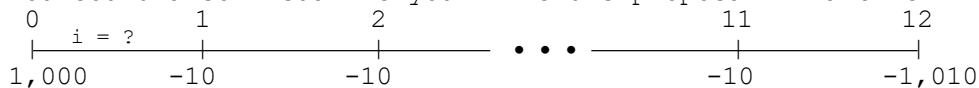
Your friend's proposal:

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

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

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

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



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

Input into a financial calculator the following:

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

126. EAR and FV of an annuity

Answer: d

Step 1: Find the effective annual rate:

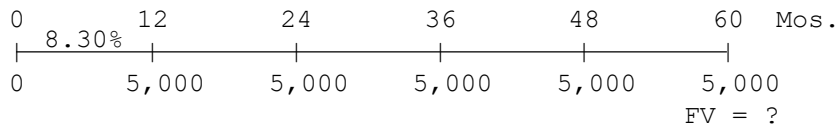
Enter the following input data in the calculator:

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

Step 2: Calculate the FV of the \$5,000 annuity at the end of 10 years:
Now, put the calculator in End mode, switch back to 1 P/YR, and enter the following input data in the calculator:
N = 10; I/YR = 9.3807; PV = 0; PMT = -5000; and solve for FV = \$77,358.80 \approx \$77,359.

127. EAR and FV of an annuity

Answer: b



Step 1: Because the interest is compounded monthly, but payments are made annually, you need to find the interest rate for the payment period (the effective rate for one year).
Enter the following input data in your calculator:
NOM% = 8; P/YR = 12; EFF% = 8.30%.
Now use this rate as the interest rate. Remember to switch back P/YR = 1.

Step 2: Find the FV of the annuity:
N = 5; I/YR = 8.30; PV = 0; PMT = -5000; and solve for FV = \$29,508.98.

128. Remaining loan balance

Answer: a

Step 1: Solve for the monthly payment:
Enter the following input data in the calculator:
N = 60; I/YR = 12/12 = 1; PV = -15000; FV = 0; and solve for PMT = \$333.6667.

Step 2: Determine the loan balance remaining after the 30th payment:
1 INPUT 30 ■ AMORT

= displays Int: \$3,621.1746
= displays Prin: \$6,388.8264
= displays Bal: \$8,611.1736.
Therefore, the balance will be \$8,611.17.

129. Remaining mortgage balance

Answer: c

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

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

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

1 INPUT 60 ■ AMORT

= displays Int: \$110,393.67

= displays Prin: \$10,299.93

= displays Bal: \$239,700.07.

130. Remaining mortgage balance

Answer: d

Solve for the monthly payment as follows:

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

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

$3 \times 12 = 36$ payments

1 INPUT 36 ■ AMORT

= displays Int: \$35,543.52

= displays Prin: \$4,079.88

= displays Bal: \$145,920.12.

131. Amortization

Answer: c

Step 1: Determine the monthly payment of the mortgage:

Enter the following inputs in the calculator:

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

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

1 INPUT 36 ■ AMORT

= displays Int: \$39,097.8616.

132. Required annuity payments

Answer: c

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/YR = 10; NPV = \$7.2937 million.

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

Now, calculate the annual payments:

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

133. Required annuity payments

Answer: b

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

Enter the following inputs in the calculator:

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

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

Enter the following inputs in the calculator:

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

134. Required annuity payments

Answer: c

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

Enter the following input data in the calculator:

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

This is how much the house will cost.

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

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

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

Step 3: Determine the down payment needed:

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

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

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

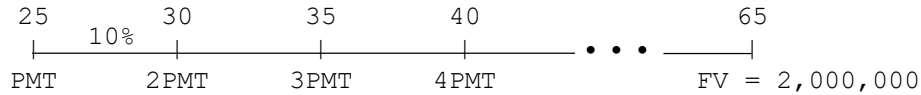
Step 4: Determine how much they need to deposit each year to reach this goal:

$$N = 5; I/YR = 10; PV = -2000; FV = 63959.11; \text{ and solve for } PMT = \$9,948.75 \approx \$9,949.$$

135. Required annuity payments

Answer: a

Here's a time line depicting the problem:



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

136. Monthly vs. quarterly compounding

Answer: c

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

Step 1: Find the effective rate on the account with monthly compounding:
 NOM% = 5; P/YR = 12; and solve for EFF% = 5.1162%.

Step 2: Translate the effective rate to a nominal rate based on quarterly compounding:
 EFF% = 5.1162; P/YR = 4; and solve for NOM% = 5.0209% \approx 5.02%.

137. Effective annual rate

Answer: d

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

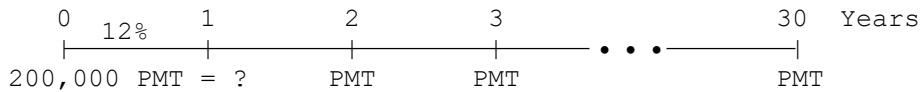
$$EAR_{Dly} = \left(1 + \frac{0.09}{365}\right)^{365} - 1 = 9.42\%.$$

$$\text{Difference} = 10.38\% - 9.42\% = 0.96\%.$$

138. Amortization

Answer: c

Time Line:



Financial calculator solution:

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

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

139. Amortization: repayment of principal

Answer: a

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

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

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

3 INPUT 3 ■ AMORT
 = displays Int: \$1,698.84
 = displays Prin: \$7,757.16
 = displays Bal: \$77,181.86.

140. Amortization: interest paid

Answer: c

Enter the following inputs in the calculator:

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

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

Use the calculator's amortization feature:

$12 \times 2 = 24$ payments
 1 INPUT 24 ■ AMORT
 = displays Int: \$16,092.44.

Percentage of first two years that is interest is:

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

141. Amortization: repayment of principal

Answer: e

Step 1: Calculate the monthly mortgage payment:

Enter the following inputs in the calculator:

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

- Step 2: Obtain the amortization schedule for the fourth year (months 37-48) by using the calculator's amortization feature:
 37 INPUT 48 ■ AMORT
 = displays Int: \$9,428.2512
 = displays Prin: \$1,623.0048.
- Step 3: Calculate the percentage of payments in the fourth year that will go towards the repayment of principal:
 $\$1,623.0048 / (\$920.938 \times 12) = 0.1469 = 14.69\%$.

142. Amortization: remaining mortgage balance **Answer: b**

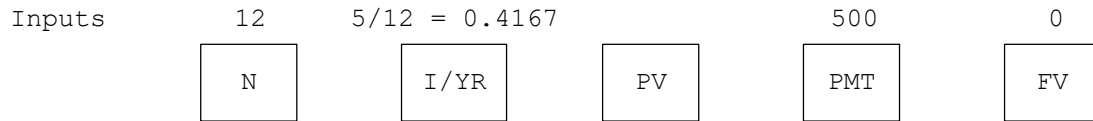
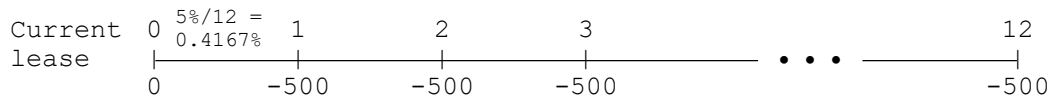
- Step 1: Find the monthly mortgage payment by entering the following inputs in your calculator:
 $N = 360$; $I/YR = 8/12 = 0.667$; $PV = -300000$; $FV = 0$; and solve for $PMT = \$2,201.29$.
- Step 2: Calculate the remaining principal balance after 5 years by using your financial calculator's amortization feature.
 60 INPUT ■ AMORT
 = displays Int: \$1,903.38
 = displays Prin: \$297.91
 = displays Bal: \$285,209.57.

143. Amortization: remaining loan balance **Answer: d**

- Step 1: Calculate the common monthly payment using the information you know about Jamie's loan:
 $N = 48$; $I/YR = 12/12 = 1$; $PV = -15000$; $FV = 0$; and solve for $PMT = \$395.0075$.
- Step 2: Calculate how much Jake's car cost using the information you know about his loan and the monthly payment solved in Step 1:
 $N = 60$; $I/YR = 12/12 = 1$; $PMT = -395.0075$; $FV = 0$; and solve for $PV = \$17,757.5787$.
- Step 3: Calculate the balance on Jake's loan at the end of 48 months by using the calculator's amortization feature:
 1 INPUT 48 ■ AMORT
 = displays Int: \$5,648.62
 = displays Prin: \$13,311.74
 = displays Bal: \$4,445.84.

144. NPV and non-annual discounting

Answer: b



Output = -5,840.61



$CF_0 = 0$; $CF_{1-3} = 0$; $CF_{4-12} = -700$; $I/YR = 0.4167$; and 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 $\$253.62$.

145. FV of an annuity

Answer: c

Step 1: The value of what they have saved so far is:
Enter the following input data in the calculator:
 $N = 25$; $I/YR = 12$; $PV = -20000$; $PMT = -5000$; and solve for $FV = \$1,006,670.638$.

Step 2: Deduct the amount to be paid out in 3 years:
Enter the following input data in the calculator:
 $N = 3$; $I/YR = 12$; $PMT = 0$; $FV = 150000$; and solve for $PV = \$106,767.037$.
The value remaining is $\$1,006,670.638 - \$106,767.037 = \$899,903.601$.

Step 3: Determine how much will be in the account on their 58th birthday, after 8 more annual contributions:
Enter the following input data in the calculator:
 $N = 8$; $I/YR = 12$; $PV = -899903.601$; $PMT = -5000$; and solve for $FV = \$2,289,626.64 \approx \$2,289,627$.

146. FV of annuity due

Answer: a

First, convert the 9% 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.

147. Value of missing cash flow

Answer: d

Financial calculator solution:

Enter the first 4 cash flows, enter I/YR = 15, and solve for NPV = -\$58.945. The future value of \$58.945 will be the required cash flow.

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

148. EAR and FV of annuity

Answer: c

First, we must find the appropriate effective rate of interest. Using your calculator enter the following data as inputs as follows:

NOM% = 6; P/YR = 12; and solve for EFF% = 6.167781%.

Since the contributions are being made every 6 months, we need to determine the nominal annual rate based on semiannual compounding. Enter the following data in your calculator as follows:

EFF% = 6.167781%; P/YR = 2; and solve for NOM% = 6.0755%.

Now, use the periodic rate $6.0755\%/2 = 3.037751\%$ to calculate the FV of the annuities due. Now, we must solve for the value of all contributions as of the end of Year 2. Enter the following data inputs in your calculator:

N = 4; I/YR = 3.037751; PV = 1000; PMT = 1000; and solve for FV = \$5,313.14.

So, these contributions will be worth \$5,313.14 as of the end of Year 2. Now, we must find the value of this investment after the eighth year. For this calculation, we can use annual periods and the effective annual rate calculated earlier. Enter the following data as inputs to your calculator:

$N = 6$; $I/YR = 6.167781$; $PV = -5313.14$; $PMT = 0$; and solve for $FV = \$7,608.65 \approx \$7,609$.

149. FV of investment account

Answer: b

We need to figure out how much money they would have saved if they didn't pay for the college costs.

$N = 40$; $I/YR = 10$; $PV = 0$; $PMT = -12000$; and solve for $FV = \$5,311,110.67$.

Now figure out how much they would use for college costs. First get the college costs at one point in time, $t = 20$, using the cash flow register. $CF_0 = 58045$; $CF_1 = 62108$; $CF_2 = 66,456 \times 2 = 132912$ (two kids in school); $CF_3 = 71,108 \times 2 = 142216$; $CF_4 = 76086$; $CF_5 = 81411$; $I/YR = 10$; $NPV = \$433,718.02$.

The value of the college costs at year $t = 20$ is \$433,718.02. What we want is to know how much this is at $t = 40$.

$N = 20$; $I/YR = 10$; $PV = -433718.02$; $PMT = 0$; and solve for $FV = \$2,917,837.96$.

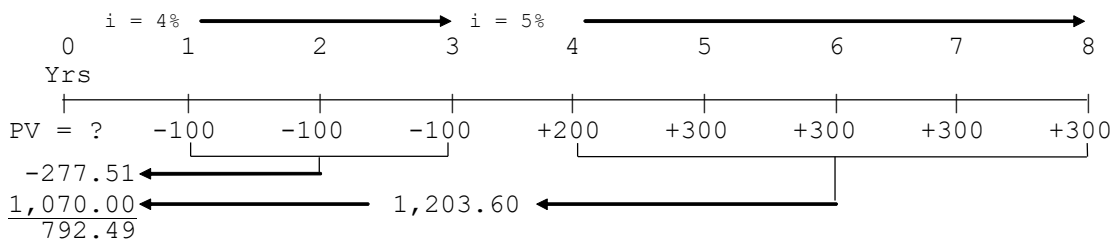
The amount in the nest egg at $t = 40$ is the amount saved less the amount spent on college.

$\$5,311,110.67 - \$2,917,837.96 = \$2,393,272.71 \approx \$2,393,273$.

150. PV of an uneven CF stream

Answer: c

Time Line:



Financial calculator solution:

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

Output: $NPV = -277.51$.

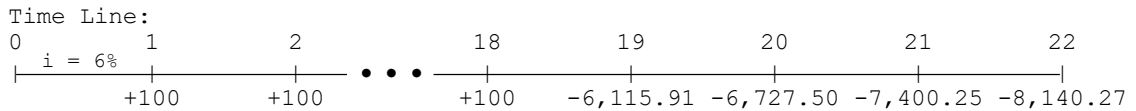
Calculate the PV of CFs 4-8 as of time = 3 at $i = 5\%$
 Inputs: $CF_0 = 0$; $CF_1 = 200$; $CF_2 = 300$; $N_j = 4$; $I/YR = 5$.
 Output: $NPV_3 = \$1,203.60$.

Calculate PV of the FV of the positive CFs at time = 3
 Inputs: $N = 3$; $I/YR = 4$; $PMT = 0$; $FV = -1203.60$.
 Output: $PV = \$1,070$.

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

151. PV of an uneven CF stream

Answer: d



$-\$8,554.84$ PV of health care costs
 $\underline{1,082.76}$ PV of parents' savings
 $\underline{-\$7,472.08}$ Lump sum government must set aside

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

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

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

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

152. Required annuity payments

Answer: b

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

Financial calculator solution:
 Enter cash flows in CF register; $I/YR = 8$; solve for $NPV = \$95,244.08$.
 Calculate annuity:
 $N = 5$; $I/YR = 8$; $PV = -50000$; $FV = 95244.08$; and solve for $PMT = \$3,712.15$.

153. Required annuity payments

Answer: b

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

Remember, costs are incurred at end of year.

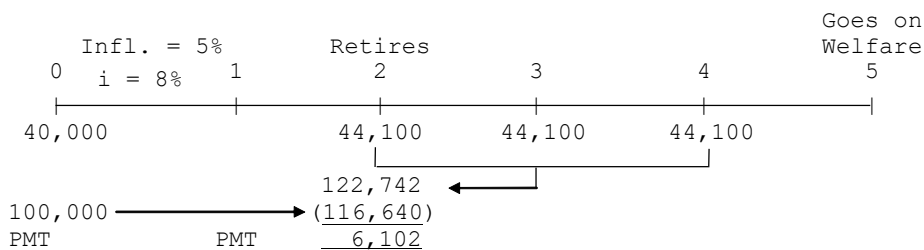
$CF_0 = 25000$; $CF_1 = 25000$; $CF_2 = 50000$; $CF_3 = 50000$; $CF_4 = 25000$; $CF_5 = 25000$; $I/YR = 8$; and solve for $NPV = \$166,097.03$.

Step 2: Calculate the annual required deposit:

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

154. Required annuity payments

Answer: c



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

$\$40,000(1 + \text{Infl.})^2 = \$40,000(1.05)^2 = \$44,100$.

Step 2: There will be 3 retirement payments of $\$44,100$, made at $t = 2$, $t =$

3, and $t = 4$. We find the PV of an annuity due at $t = 2$ as follows:
 Set calculator to BEGIN mode. Then enter:
 $N = 3$; $I/YR = 8$; $PMT = 44100$; $FV = 0$; and 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
 $\$122,742 - \$116,640 = \$6,102$:

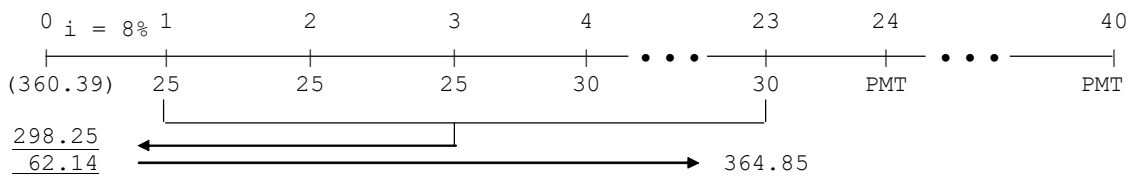
Need at $t = 2$ $\$122,742$
 Will have $(\$116,640)$
 Net additional needed $\underline{\$6,102}$

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 mode. Then enter:
 $N = 2$; $I/YR = 8$; $PV = 0$; $FV = 6102$; and solve for $PMT = \$2,716$.

155. Required annuity payments

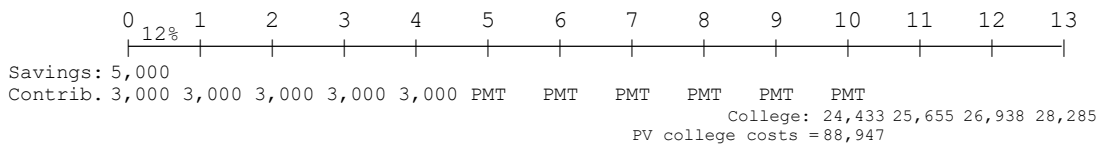
Answer: c



Calculate the NPV of payments in Years 1-23:
 $CF_0 = 0$; $CF_{1-3} = 25$; $CF_{4-23} = 30$; $I/YR = 8$; and 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:
 $N = 23$; $I/YR = 8$; $PV = -62.14$; $PMT = 0$; and solve for $FV = \$364.85$.
 Calculate the value of the annuity payments in Years 24-40:
 $N = 17$; $I/YR = 8$; $PV = -364.85$; $FV = 0$; and solve for $PMT = \$40$.

156. Required annuity payments

Answer: a



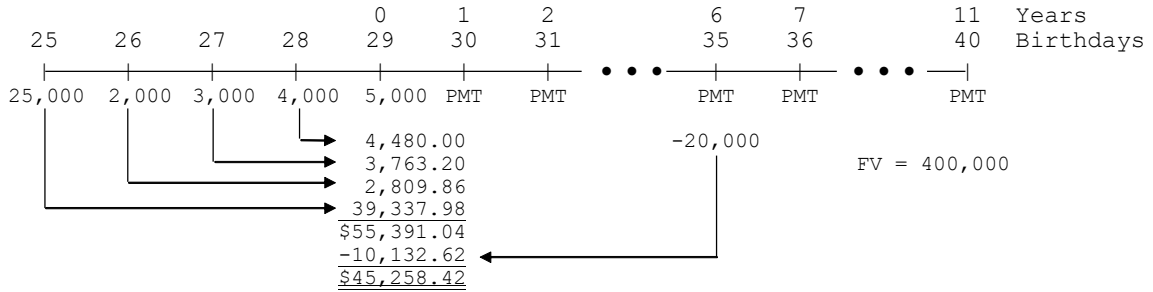
Step 1: Determine college costs:
 College costs will be $\$15,000(1.05)^{10} = \$24,433$ at $t = 10$,
 $\$15,000(1.05)^{11} = \$25,655$ at $t = 11$, $\$15,000(1.05)^{12} = \$26,938$
 at $t = 12$, and $\$15,000(1.05)^{13} = \$28,285$ at $t = 13$.
 Step 2: Determine PV of college costs at $t = 10$:
 Enter the cash flows into the cash flow register as follows:
 $CF_0 = 24433$; $CF_1 = 25655$; $CF_2 = 26938$; $CF_3 = 28285$; $I/YR = 12$;
 and solve for $NPV = \$88,947$.

Step 3: Determine the value of their savings at $t = 4$ as follows:
 $N = 4$; $I/YR = 12$; $PV = 8000$; $PMT = 3000$; and solve for $FV = \$26,926$.

Step 4: Determine the value of the annual contributions from $t = 5$ through $t = 10$:
 $N = 6$; $I/YR = 12$; $PV = -26926$; $FV = 88947$; and solve for $PMT = -\$4,411$.

157. Required annuity payments

Answer: a



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):
 $N = 6$; $I/YR = 12$; $PMT = 0$; $FV = 20000$; and solve for $PV = \$10,132.62$. (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:
 $N = 11$; $I/YR = 12$; $PV = -45258.42$; $FV = 400000$; and solve for $PMT = \$11,743.95$.

158. Required annuity payments

Answer: c

Step 1: Convert the 9% 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. BEGIN mode. Then, enter $N = 15$; $I/YR = 9.3807$; $PV = 0$; $PMT = 2000$; and 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 $N = 25$; $I/YR = 12$; $FV = 3000000$; $PMT = 0$; and solve for $PV = \$176,469.92$.

Step 4: Find the shortfall today, the difference between the present value of what he needs in 25 years and the present value of what he's accumulated today. $\$176,469.92 - \$66,184.35 = \$110,285.57$.

Step 5: Find the annuity needed to cover this shortfall. Since the contributions begin today this is an annuity due, so the calculator must be set up in BEGIN mode. (Remember to change your calculator back from BEGIN to END mode after working this problem.) BEGIN mode. Then, enter $N = 26$; $I/YR = 12$; $PV = -110285.57$; $FV = 0$; and solve for $PMT = \$12,471.31 \approx \$12,471$.

159. Required annuity payments

Answer: a

- Step 1 Calculate the cost of tuition in each year:
 $\$25,000(1.05)^{15} = \$51,973.20$; $\$25,000(1.05)^{16} = \$54,571.86 \times 2 = \$109,143.73$; $\$25,000(1.05)^{17} = \$57,300.46 \times 2 = \$114,600.92$; $\$25,000(1.05)^{18} = \$60,165.48 \times 2 = \$120,330.96$; $\$25,000(1.05)^{19} = \$63,173.75$.
- Step 2 Find the present value of these costs at $t = 15$:
 $CF_0 = 51973.20$; $CF_1 = 109143.73$; $CF_2 = 114600.92$; $CF_3 = 120330.96$; $CF_4 = 63173.75$; $I/YR = 12$; and 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:
 $N = 15$; $I/YR = 12$; $PV = 0$; $FV = 221019.30$; and solve for $PMT = -\$5,928.67$.

160. Required annuity payments

Answer: b

- Step 1: Find out what the cost of college will be in six years:
 Enter the following input data in the calculator:
 $N = 6$; $I/YR = 5$; $PV = -20000$; $PMT = 0$; and solve for $FV = \$26,801.9128$.
- Step 2: Calculate the present value of his college cost:
 Enter the following input data in the calculator:
 $N = 6$; $I/YR = 10$; $PMT = 0$; $FV = 26801.9128$; and solve for $PV = \$15,128.98$.
- Step 3: Find the present value today of the \$15,000 that will be withdrawn in two years for the purchase of a used car:
 Enter the following input data in the calculator:
 $N = 2$; $I/YR = 10$; $PMT = 0$; $FV = 15000$; and solve for $PV =$

\$12,396.69.

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

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

Enter the following input data in the calculator:

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

161. Required annuity payments

Answer: e

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

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

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

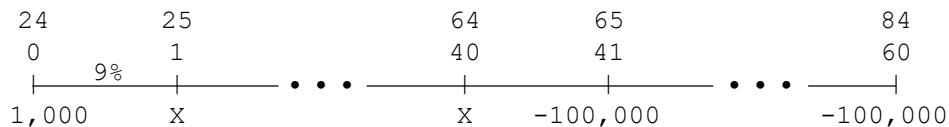
Now, we need to find the lease payment that equates to this present value. Enter the following data into your financial calculator:

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

162. Required annuity payments

Answer: c

Here is the diagram of the problem:



Step 1: Determine the PV at his 64th birthday of the cash outflows from his 65th birthday to his 84th birthday. Using a financial calculator, enter the following input data:

$N = 20$; $I/YR = 9$; $PMT = -100000$; $FV = 0$; solve $PV = \$912,854.57$.

This is the amount needed in his account on his 64th birthday in order to make 20 withdrawals of $\$100,000$ from his account.

Step 2: Determine the required annual payment (deposit) that will

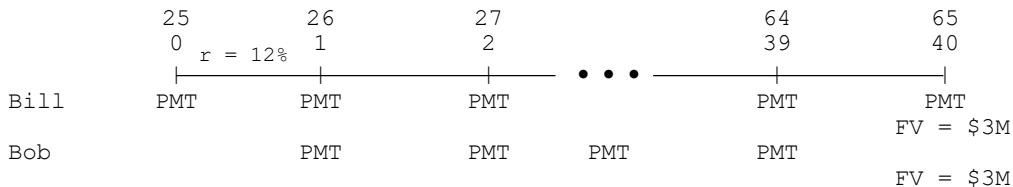
achieve this goal, given the \$1,000 original deposit. Using a financial calculator, enter the following input data:
 $N = 40$; $I/YR = 9$; $PV = -1000$; $FV = 912854.57$; solve for $PMT = \$2,608.73$.

163. Annuity due vs. ordinary annuity

Answer: e

There is more than one way to solve this problem.

Step 1: Draw the time line:



Step 2: Determine each's annual contribution:

Bill: He starts investing today, so use the BEGIN mode of the calculator.

Enter the following input data in the calculator:

$N = 41$; $I/YR = 12$; $PV = 0$; $FV = 3,000,000 \times 1.12 = 3360000$; and solve for $PMT = \$3,487.79$. (The FV is calculated as \$3,360,000 because the annuity will calculate the value to the end of the year, until Bill is a second away from age 66. Therefore, since he wants to have \$3,000,000 by age 65, he would have $\$3,000,000 \times 1.12$ one second before he turns 66.)

Bob: He starts investing at the end of this year, so use the END mode of the calculator.

Enter the following input data in the calculator:

$N = 40$; $I/YR = 12$; $PV = 0$; $FV = 3000000$; and solve for $PMT = \$3,910.88$.

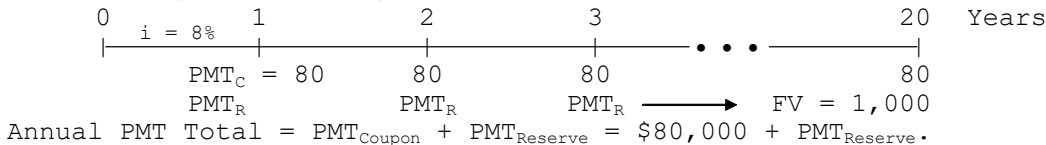
Step 3: Determine the difference between the two payments:

The difference is $\$3,910.88 - \$3,487.79 = \$423.09$.

164. Amortization

Answer: b

Time Line (in thousands):



Financial calculator solution:

Long way Inputs: $N = 20$; $I/YR = 8$; $PV = 0$; $FV = 1000000$.

Output: $PMT = -\$21,852.21$.

Add coupon interest and reserve payment together

$\text{Annual PMT}_{\text{Total}} = \$80,000 + \$21,852.21 = \$101,852.21$.

Total number of tickets = $\$101,852.21 / \$10.00 = 10,185.22 \approx 10,186$.*

Short way Inputs: $N = 20$; $I/YR = 8$; $PV = 1000000$; $FV = 0$.

the calculator:

$N = 10$; $I/YR = 8.2432$; $PV = -77508.78$; $FV = 0$; and solve for $PMT = \$10,788.78 \approx \$10,789$.

167. Value of unknown withdrawal

Answer: d

Step 1: Find out how much Steve and Robert have in their accounts today:
You can get this from analyzing Steve's account.

END mode: $N = 9$; $I/YR = 6$; $PV = -5000$; $PMT = -5000$; and solve for $FV = \$65,903.9747$.

Alternatively, BEGIN mode: $N = 9$; $I/YR = 6$; $PV = 0$; $PMT = -5000$; and solve for $FV = \$60,903.9747$.

Then add the \$5,000 for the last payment to get a total of \$65,903.9747.

This is also the value of Robert's account today.

Step 2: Find out how much Robert would have had if he had never withdrawn anything:

END mode: $N = 9$; $I/YR = 12$; $PV = -5000$; $PMT = -5000$; and solve for $FV = \$87,743.6753$.

Alternatively, BEGIN mode: $N = 9$; $I/YR = 12$; $PV = 0$; $PMT = -5000$; and solve for $FV = \$82,743.6753$.

Then add the \$5,000 for the last payment to get a total of \$87,743.6753.

Step 3: Find the difference in the value of Robert's account due to the withdrawal made:

However, since he took money out at age 27, he has only \$65,903.9747. The difference between what he has and what he would have had is:

$\$87,743.6753 - \$65,903.9747 = \$21,839.7006$.

Step 4: Determine the amount of Robert's withdrawal by discounting the value found in Step 3:

$N = 3$; $I/YR = 12$; $PMT = 0$; $FV = -21839.7006$; then solve for $PV = \$15,545.0675 \approx \$15,545.07$.

168. Non-annual compounding

Answer: a

To compare these alternatives, find the present value of each strategy and select the option with the highest present value.

Option 1 can be valued as an annuity due.

Enter the following input data in the calculator:

BEGIN mode (to indicate payments will be received at the start of the period) $N = 12$; $I/YR = 12/12 = 1$; $PMT = -1000$; $FV = 0$; and solve for $PV = \$11,367.63$.

Option 2 can be valued as a lump sum payment to be received in the future.

Enter the following input data in the calculator:

END mode (to indicate the lump sum will be received at the end of the year) $N = 2$; $I/YR = 12/2 = 6$; $PMT = 0$; $FV = -12750$; and solve for $PV = \$11,347.45$.

Option 3 can be valued as a series of uneven cash flows. The cash flows at the end of each period are calculated as follows:

$CF_0 = \$0.00$; $CF_1 = \$800.00$; $CF_2 = \$800.00(1.20) = \960.00 ; $CF_3 = \$960.00(1.20) = \$1,152.00$; $CF_4 = \$1,152.00(1.20) = \$1,382.40$; $CF_5 = \$1,382.40(1.20) = \$1,658.88$; $CF_6 = \$1,658.88(1.20) = \$1,990.66$; $CF_7 = \$1,990.66(1.20) = \$2,388.79$; $CF_8 = \$2,388.79(1.20) = \$2,866.54$.

To find the present value of this cash flow stream using your financial calculator enter:

END mode (to indicate the cash flows will occur at the end of each period) 0 CF_j ; 800 CF_j ; 960 CF_j ; 1152 CF_j ; 1382.40 CF_j ; 1658.88 CF_j ; 1990.66 CF_j ; 2388.79 CF_j ; 2866.54 CF_j (to enter the cash flows); I/YR = $12/4 = 3$; solve for NPV = \$11,267.37.

Choose the alternative with the highest present value, and hence select Choice 1 (Answer a).

169. Breakeven annuity payment **Answer: a**

Step 1: Calculate the NPV of purchasing the car by entering the following data in your financial calculator:

$CF_0 = -17000$; $CF_{1-47} = 0$; $CF_{48} = 7000$; I/YR = $6/12 = 0.5$; and solve for NPV = $-\$11,490.31$.

Step 2: Now, use the NPV calculated in Step 1 to determine the breakeven lease payment that will cause the two NPVs to be equal. Enter the following data in your financial calculator:

$N = 48$; I/YR = 0.5; $PV = -11490.31$; $FV = 0$; and solve for PMT = \$269.85.

170. Required mortgage payment **Answer: b**

Just enter the following data into your calculator and solve for the monthly mortgage payment.

$N = 360$; I/YR = $7/12 = 0.583333$; $PV = -115000$; $FV = 0$; and solve for PMT = $\$765.0979 \approx \765.10 .

171. Remaining mortgage balance **Answer: e**

With the data still input into your calculator, press 1 INPUT 60 ■ AMORT
= displays Interest: \$39,157.2003
= displays Principal: \$6,748.6737
= displays Balance: \$108,251.3263

172. Time to accumulate a lump sum **Answer: d**

You must solve this time value of money problem for N (number of years) by entering the following data in your calculator:

I/YR = 10; PV = -2000; PMT = -1000; FV = 1000000; and solve for N = 46.51.

Because there is a fraction of a year and the problem asks for whole years, we must round up to the next year. Hence, the answer is 47 years.

173. Required annual rate of return **Answer: c**

Now, the time value of money problem has been modified to solve for I/YR. Enter the following data in your calculator:

N = 39; PV = -2000; PMT = -1000; FV = 1000000; and solve for I/YR = 12.57%.

174. Monthly mortgage payments **Answer: c**

Enter the following data as inputs in your calculator:

N=30×12 = 360; I/YR=7.2/12=0.60; PV=-100000; FV=0; solve PMT = \$678.79.

175. Amortization **Answer: d**

Determine the mortgage payment, then input:

1 INPUT 36 ■ AMORT

= Interest: \$21,280.8867

= Principal: \$3,155.4885

= Balance: \$96,844.5115.

The percentage that goes to principal = $\frac{\$3,155.49}{36 \times \$678.79} = \frac{\$3,155.49}{\$24,436.44} = 12.91\%$.

176. Monthly mortgage payments **Answer: d**

Using your financial calculator, enter the following data inputs:

N = 180; I/YR = 7.75/12 = 0.645833; PV = -165000; FV = 0; and solve for PMT = \$1,553.104993 ≈ \$1,553.10.

177. Remaining mortgage balance **Answer: c**

The complete solution looks like this:

Beginning of Period	Mortgage Balance	Payment	Interest	Ending Mortgage Balance
1	\$165,000.00	\$1,553.10	\$1,065.63	\$164,512.52
2	164,512.52	1,553.10	1,062.48	164,021.89
3	164,021.89	1,553.10	1,059.31	163,528.09
4	163,528.09	1,553.10	1,056.12	163,031.11
5	163,031.11	1,553.10	1,052.91	162,530.91
6	162,530.91	1,553.10	1,049.68	162,027.49
7	162,027.49	1,553.10	1,046.43	161,520.81
8	161,520.81	1,553.10	1,043.16	161,010.86

9	161,010.86	1,553.10	1,039.86	160,497.62
10	160,497.62	1,553.10	1,036.55	159,981.06
11	159,981.06	1,553.10	1,033.21	159,461.16
12	159,461.16	1,553.10	1,029.85	158,937.91

Alternatively, using your financial calculator, do the following (with the data still entered from the previous problem):

```
1 INPUT 12 ■ AMORT
= Interest: $12,575.172755
= Principal: $6,062.087161
= Balance: $158,937.912839
```

178. Amortization

Answer: d

Step 1: Find the monthly payment:

```
N=360; I/YR=8/12=0.6667; PV=75000; FV=0; solve PMT =
$550.3234.
```

Step 2: Calculate value of monthly payments for the first year:

Total payments in the first year = $\$550.3234 \times 12 = \$6,603.8812$.

Step 3: Determine amount of interest during first year:

```
1 INPUT 12 ■ AMORT
= Interest: $5,977.3581
= Principal: $626.5227
= Balance: $74,373.4773
```

Step 4: Calculate the percentage that goes towards interest:

$\$5,977.3581 / \$6,603.8812 = 0.9051$, or 90.51%.

179. Amortization

Answer: a

Step 1: Calculate old monthly payment:

```
N = 360; I/YR = 8/12 = 0.6667; PV = 75000; FV = 0; and solve
for PMT = $550.3234.
```

Step 2: Calculate new monthly payment:

```
N = 360; I/YR = 7/12 = 0.5833; PV = 75000; FV = 0; and solve
for PMT = $498.9769.
```

Step 3: Calculate the difference between the 2 mortgage payments:

This represents a savings of $(\$550.3234 - \$498.9769) = \$51.3465 \approx \51.35 .

180. Monthly mortgage payment

Answer: c

Enter the following data in your calculator:

$N = 360$; $I/YR = 7.2/12 = 0.60$; $PV = 300000$; $FV = 0$; and solve for $PMT = \$2,036.3646 \approx \$2,036.36$.

181. Amortization

Answer: b

Using a financial calculator and the above information:

1 INPUT 12 ■ AMORT
= Interest: \$21,504.5022
= Principal: \$2,931.8730
= Balance: \$297,068.1270

The percent paid toward principal = $\$2,931.87 / (\$2,931.87 + \$21,504.50)$
= 12%.

WEB APPENDIX 2A SOLUTIONS

2A-1. PV continuous compounding

Answer: b EASY/MEDIUM

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

2A-2. FV continuous compounding

Answer: a MEDIUM

Daily compounding:

$$FV_2 = PV (1 + 0.06/365)^{365(2)} = \$1,000 (1.12749) = \$1,127.49$$

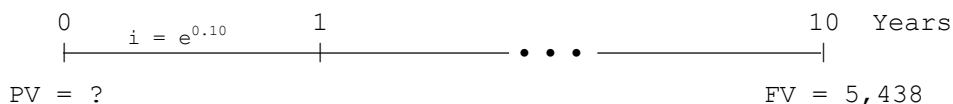
Continuous compounding:

$$FV_2 = PVe^{in} = \$1,000 (e^{0.059(2)}) = \$1,000 (1.12524) = \underline{\underline{\$1,125.24}}$$

$$\text{Difference between accounts} \quad \underline{\underline{\$2.25}}$$

2A-3. Continuous compounding

Answer: b MEDIUM



Numerical solution:
 (Constant $e = 2.7183$ rounded.)
 $\$5,438 = PVe^{0.10(10)}$
 $\$5,438 = PVe^1$
 $PV = \$5,438/e$
 $= \$5,438/2.7183 = \$2,000.52 \approx \$2,000.$

Financial calculator solution:
 Use e^x exponential key on calculator. Calculate EAR with continuous compounding.
 Inputs: $X = 0.10$; press e^x key.
 Output: $e^x = 1.1052$.
 $EAR = 1.1052 - 1.0 = 0.1052 = 10.52\%$.
 Calculate PV of FV discounted continuously
 Inputs: $N=10$; $I/YR=10.52$; $PMT=0$; $FV=5438$. Output: $PV=-\$2,000$.

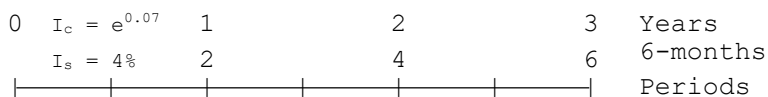
2A-4. Continuous compounded interest rate Answer: a MEDIUM/HARD

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

Take the natural logarithm of both sides:
 $i(4) \ln e = \ln 1.35579$.
 The natural log of $e = 1.0$.
 Inputs: 1.35579 . Press LN key. Output: $LN = 0.30438$.

$i(4) \ln e = \ln 1.35579$
 $i(4) = 0.30438$
 $i = 0.0761 = 7.61\%$.

2A-5. Payment and continuous compounding Answer: d MEDIUM/HARD



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

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

Step 1: Calculate the FV of the $\$1,000$ deposit at 7% with continuous compounding:
 Using e^x key:
 Inputs: $X = 0.21$; press e^x key. Output: $e^x = 1.2337$.

$$FV_n = \$1,000 e^{0.07(3)} = \$1,000(1.2337) = \$1,233.70.$$

Step 2: Calculate the PV or initial deposit:

Inputs: N = 6; I/YR = 4; PMT = 0; FV = 1233.70.

Output: PV = -\$975.01.

2A-6. Continuous compounding

Answer: d MEDIUM/HARD

Numerical solution:

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

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

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

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

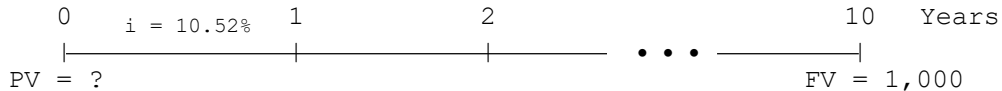
$$\frac{i}{2} = 0.0202$$

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

2A-7. Continuous compounding

Answer: b MEDIUM/HARD

Time Line:



Numerical solution:

$$\$1,000 = PVe^{0.10(10)} = PVe^{1.0}$$

$$PV = \$1,000/e = \$1,000/2.7183 = \$367.88 \approx \$368.$$

Financial calculator solution:

Use e^x exponential key on calculator. Calculate EAR with continuous compounding.

Inputs: X = 0.10; press e^x key. Output: e^x = 1.1052.

