Chapter 4 Solutions to Problems

1. \( P/Y = 1, C/Y = 1, N = 6, I/Y = 10, PV = -1,000, PMT = 0. \) CPT FV. \( FV = \$1,771.56. \)

2. \( P/Y = 1, C/Y = 1, N = 3, I/Y = 5, PV = -50,000, PMT = 0. \) CPT FV. \( FV = \$57,881.25. \)
   
   \( P/Y = 1, C/Y = 1, N = 6, I/Y = 5, PV = -50,000, PMT = 0. \) CPT FV. \( FV = \$67,004.78. \)

3. a. \( P/Y = 1, C/Y = 1, N = 10, I/Y = 15, PMT = 0, FV = 20,000. \) CPT PV. \( PV = \$4,943.69. \)
   
   b. \( P/Y = 1, C/Y = 1, N = 5, I/Y = 15, PMT = 0, FV = 15,000. \) CPT PV. \( PV = \$7,457.65. \)
   
   c. PV of $8,000 today is $8,000.

4. \( P/Y = 1, C/Y = 1, N = 8, I/Y = 6, PMT = 0, FV = 100,000. \) CPT PV. \( PV = \$62,741.24. \)

5. \( P/Y = 1, C/Y = 1, N = 25, I/Y = 6, PV = -4,800, PMT = 0. \) CPT FV. \( FV = \$20,600.98. \)
   
   \( P/Y = 1, C/Y = 1, N = 60, I/Y = 6, PV = -4,800, PMT = 0. \) CPT FV. \( FV = \$158,340.92. \)

6. \( P/Y = 1, C/Y = 1, N = 8, I/Y = 5, PMT = 0, FV = 20,000. \) CPT PV. \( PV = \$13,536.79. \)

7. \( P/Y = 1, C/Y = 1, N = 1, I/Y = 10, PMT = 0, FV = 100,000. \) CPT PV. \( PV = \$90,909.09. \)
   
   \( P/Y = 1, C/Y = 1, N = 2, I/Y = 10, PMT = 0, FV = 200,000. \) CPT PV. \( PV = \$165,289.26. \)
   
   \( P/Y = 1, C/Y = 1, N = 3, I/Y = 10, PMT = 0, FV = 300,000. \) CPT PV. \( PV = \$225,394.44. \)
   
   Sum of PVs = $481,592.79

8. \( P/Y = 1, C/Y = 1, N = 2, I/Y = 7, PV = -10,500, PMT = 0. \) CPT FV. \( FV = \$12,021.45. \)
9. \[ P/Y = 1, \ C/Y = 1, \ N = 10, \ I/Y = 9, \ \text{PMT} = 6,000, \ \text{FV} = 0. \ \text{CPT PV. PV} = 38,505.95. \]

\[ P/Y = 1, \ C/Y = 1, \ N = 20, \ I/Y = 9, \ \text{PMT} = 3,000, \ \text{FV} = 0. \ \text{CPT PV. PV} = 27,385.64. \]

The 10-year annuity is worth more today.

10. \[ P/Y = 1, \ C/Y = 1, \ N = 30, \ I/Y = 9, \ \text{PV} = 0, \ \text{PMT} = 5,000. \ \text{CPT FV. FV} = 681,537.69. \]

11. PV of $1,000,000 now is $1,000,000.

\[ P/Y = 1, \ C/Y = 1, \ N = 25, \ I/Y = 8, \ \text{PMT} = 100,000, \ \text{FV} = 0. \ \text{CPT PV. PV} = 1,067,477.62. \]

The annuity is the better choice because it is worth more than $1,000,000 today.

12. \[ P/Y = 1, \ C/Y = 1, \ N = 35, \ I/Y = 6, \ \text{PV} = 0, \ \text{PMT} = 3,000. \ \text{CPT FV. FV} = 334,304.34. \]

Principal contributed = $3,000/year x 35 years = $105,000.

Interest earned = $334,304.34 − $105,000 = $229,304.34.

13. a. PV of $20,000 immediately is $20,000.

\[ P/Y = 1, \ C/Y = 1, \ N = 3, \ I/Y = 12, \ \text{PMT} = 3,000, \ \text{FV} = 0. \ \text{CPT PV. PV} = 7,205.49. \]

\[ P/Y = 1, \ C/Y = 1, \ N = 6, \ I/Y = 12, \ \text{PMT} = 10,000, \ \text{FV} = 0. \ \text{CPT PV. PV} = 41,114.07. \]

\[ P/Y = 1, \ C/Y = 1, \ N = 3, \ I/Y = 12, \ \text{PMT} = 10,000, \ \text{FV} = 0. \ \text{CPT PV. PV} = 24,018.31. \]

Sum of PVs = $7,205.49 + ($41,114.07 - $24,018.31)

= $7,205.49 + $17,095.76 = $24,301.25
The annuity is the better choice because it is worth more than $20,000 today.

b. \( P/Y = 1, C/Y = 1, N = 6, I/Y = 12, PMT = 0, FV = 20,000. \) CPT PV. PV = $10,132.62.

The annuity from Part a is the better choice because it is worth more than $10,132.62 today. In fact, if you already chose the annuity over $20,000 today, you would always choose the annuity over $20,000 to be received at any time later in the future.

14. \( P/Y = 1, C/Y = 1, N = 3, PV = -10,000, PMT = 0, FV = 15,000. \) CPT I/Y. I/Y = 14.47%.

15. \( P/Y = 1, C/Y = 1, N = 8, PV = -4, PMT = 0, FV = 6. \) CPT I/Y. I/Y = 5.2%.

16. \( P/Y = 1, C/Y = 1, N = 10, PV = -1,000, PMT = 0, FV = 2,500. \) CPT I/Y. I/Y = 9.6%.

17. \( P/Y = 1, C/Y = 1, N = 6, PV = -27, PMT = 0, FV = 73. \) CPT I/Y. I/Y = 18.03%.

18. Use any starting amount as your PV. Increase that amount by 50% and use that as your FV.

\( P/Y = 1, C/Y = 1, N = 3, PV = -100, PMT = 0, FV = 150. \) CPT I/Y. I/Y = 14.47%.

19. \( P/Y = 1, C/Y = 1, N = 10, PV = -50,000, PMT = 8,000, FV = 0. \) CPT I/Y. I/Y = 9.6%.

20. \( P/Y = 1, C/Y = 1, I/Y = 6, PV = -1,000, PMT = 0, FV = 2,500. \) CPT N. N = 15.73 years.

21. \( P/Y = 1, C/Y = 1, I/Y = 3, PV = -6, PMT = 0, FV = 9. \) CPT N. N = 13.72 years.

22. Annually: \( P/Y = 1, C/Y = 1, N = 6, I/Y = 12, PV = -50,000, PMT = 0. \) CPT FV. FV = $98,691.13.

Semiannually: \( P/Y = 1, C/Y = 2, N = 6, I/Y = 12, PV = -50,000, PMT = 0. \) CPT FV. FV = $100,609.82.

Quarterly: \( P/Y = 1, C/Y = 4, N = 6, I/Y = 12, PV = -50,000, PMT = 0. \) CPT FV. FV = $101,639.71.

Monthly: \( P/Y = 1, C/Y = 12, N = 6, I/Y = 12, PV = -50,000, PMT = 0. \) CPT FV. FV = $102,354.97.
23. **Annually**: P/Y = 1, C/Y = 1, N = 5, I/Y = 10, PMT = 0, FV = 10,000. CPT PV. PV = $6,209.21.

**Semiannually**: P/Y = 1, C/Y = 2, N = 5, I/Y = 10, PMT = 0, FV = 10,000. CPT PV. PV = $6,139.13.

**Quarterly**: P/Y = 1, C/Y = 4, N = 5, I/Y = 10, PMT = 0, FV = 10,000. CPT PV. PV = $6,102.71.

**Monthly**: P/Y = 1, C/Y = 12, N = 5, I/Y = 10, PMT = 0, FV = 10,000. CPT PV. PV = $6,077.89.

24. a. The EAR of 8% compounded annually is 8%.

Using the ICONV feature on the calculator, the EAR of 8% compounded quarterly can be found as: 

NOM = 8, C/Y = 4, EFF = 8.243216%.

b. P/Y = 1, C/Y = 1, N = 6, I/Y = 8, PV = -500, PMT = 0. CPT FV. FV = $793.44.

P/Y = 1, C/Y = 4, N = 6, I/Y = 8, PV = -500, PMT = 0. CPT FV. FV = $804.22.

25. a. NOM = 9, C/Y = 1, EFF = 9%
   b. NOM = 9, C/Y = 2, EFF = 9.2%
   c. NOM = 9, C/Y = 4, EFF = 9.31%
   d. NOM = 9, C/Y = 12, EFF = 9.38%
   e. NOM = 9, C/Y = 365, EFF = 9.42%

   The more frequent the compounding, the higher the effective annual rate of interest.

26. Monthly interest = (0.15/12) x $1,000 = 0.0125 x $1,000 = $12.50

$12.50 monthly interest x 12 months per year = $150 annual interest

NOM = 15, C/Y = 12, EFF = 16.08% effective annual rate of interest.

27. P/Y = 1, C/Y = 4, N = 2.5, I/Y = 6.75, PV = -10,000, PMT = 0. CPT FV. FV = $11,821.58.

28. P/Y = 1, C/Y = 12, N = 4, I/Y = 5.5, PV = -2,000, PMT = 0. CPT FV. FV = $2,490.90.
P/Y = 1, C/Y = 12, N = 3, I/Y = 5.5, PV = -2,500, PMT = 0. CPT FV. FV = $2,947.37.

P/Y = 1, C/Y = 12, N = 2, I/Y = 5.5, PV = -3,000, PMT = 0. CPT FV. FV = $3,347.99.

P/Y = 1, C/Y = 12, N = 1, I/Y = 5.5, PV = -3,500, PMT = 0. CPT FV. FV = $3,697.43.

P/Y = 1, C/Y = 12, N = 0, I/Y = 5.5, PV = -4,000, PMT = 0. CPT FV. FV = $4,000.

Sum of FVs = $16,483.69.

29. P/Y = 2, C/Y = 2, N = 30, I/Y = 8, PV = 0, PMT = 2,000. CPT FV. FV = $112,169.88.

30. P/Y = 1, C/Y = 4, N = 40, I/Y = 8, PV = 0, PMT = 3,000. CPT FV. FV = $828,678.04.

31. P/Y = 12, C/Y = 12, N = 60, I/Y = 4.25, PV = 0, PMT = 200. CPT FV. FV = $13,344.11.

32. Goal: P/Y = 1, C/Y = 1, N = 20, I/Y = 10, PV = 0, PMT = 2,000. CPT FV. FV = $114,550.

Contributions to Date: P/Y = 1, C/Y = 1, N = 8, I/Y = 10, PV = 0, PMT = 2,000. CPT FV. FV = $22,871.78.

Future Value of Previous Contributions: P/Y = 1, C/Y = 1, N = 12, I/Y = 9, PV = -22,871.78, PMT = 0. CPT FV. FV = $64,330.65.

Amount Needed to Reach Goal: $114,550 - $64,330.65 = $50,219.35

Annual Payment for Next 12 Years: P/Y = 1, C/Y = 1, N = 12, I/Y = 9, PV = 0, FV = 50,219.35. CPT PMT. PMT = $2,493.42.

33. P/Y = 12, C/Y = 12, N = 60, I/Y = 8, PMT = 1,000, FV = 0. CPT PV. PV = $49,318.43, which is the amount Mr. Frank can finance and have monthly payments of $1,000. If the car costs $75,000, then Mr. Frank must sell his old car for $75,000 - $49,318.43 = $25,681.57.

34. a. P/Y = 12, C/Y = 12, N = 360, I/Y = 12, PV = -390,000, FV = 0. CPT PMT. PMT = $4,011.59.

b. $4,011.59 monthly payment x 360 months = $1,444,172.40 total payments.
c. $1,444,172.40 total payments - $390,000 principal borrowed = $1,054,172.40 interest paid over the life of the loan.

35. a. P/Y = 1, C/Y = 1, N = 10, I/Y = 10, PV = -50,000, FV = 0. CPT PMT. PMT = $8,137.27.

b. $8,137.27 annual payment x 10 years = $81,372.70 total paid

$81,372.70 total paid - $50,000 amount borrowed = $31,372.70 total interest paid over the life of the loan.

Ms. Freed is only being “ripped off” if other borrowers are able to obtain loans at an interest rate less than 10%.

36. a. P/Y = 1, C/Y = 1, N = 4, I/Y = 12, PV = -100,000, FV = 0. CPT PMT. PMT = $32,923.44, which will be rounded to $32,924 for Part b below.

b. | Year | Beginning Balance | Annual Payment | Dollar Interest | Principal Repayment | Ending Balance |
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*The last payment would be adjusted to $32,921 so that the balance would come out to exactly zero.

37. To find the present value of a perpetuity, divide the cash flow by the discount rate: $2,000/0.10 = $20,000.