Answers to Chapter 2
Questions:

1. The household sector (consumers) is one of the largest supplier of loanable funds. Households supply funds when they have excess income or want to reinvest a part of their wealth. For example, during times of high growth households may replace part of their cash holdings with earning assets. As the total wealth of the consumer increases, the total supply of funds from that household will also generally increase. Households determine their supply of funds not only on the basis of the general level of interest rates and their total wealth, but also on the risk on financial securities change. The greater a security's risk, the less households are willing to invest at each interest rate. Further, the supply of funds provided from households will depend on the future spending needs. For example, near term educational or medical expenditures will reduce the supply of funds from a given household.

Higher interest rates will also result in higher supplies of funds from the business sector. When businesses mismatch inflows and outflows of cash to the firm they have excess cash that they can invest for a short period of time in financial markets. In addition to interest rates on these investments, the expected risk on financial securities and the business' future investment needs will affect the supply of funds from businesses.

Loanable funds are also supplied by some government units that temporarily generate more cash inflows (e.g., taxes) than they have budgeted to spend. These funds are invested until they are needed by the governmental agency. Additionally, the federal government (i.e., the Federal Reserve) implements monetary policy by influencing the availability of credit and the growth in the money supply. Monetary policy implementation in the form of increases the money supply will increase the amount of loanable funds available.

Finally, foreign investors increasingly view U.S. financial markets as alternatives to their domestic financial markets. When interest rates are higher on U.S. financial securities than on comparable securities in their home countries, foreign investors increase the supply of funds to U.S. markets. Indeed, the high savings rates of foreign households combined with relatively high U.S. interest rates compared to foreign rates, has resulted in foreign market participants as major suppliers of funds in U.S. financial markets. Similar to domestic suppliers of loanable funds, foreign suppliers assess not only the interest rate offered on financial securities, but also their total wealth, the risk on the security, and their future spending needs. Additionally, foreign investors alter their investment decisions as financial conditions in their home countries change relative to the U.S. economy.

2. Households (although they are net suppliers of funds) borrow funds in financial markets. The demand for loanable funds by households comes from their purchases of homes, durable goods (e.g., cars, appliances), and nondurable goods (e.g., education expenses, medical expenses). In addition to the interest rate on borrowed funds, the greater the utility the household receives from the purchased good, the higher the demand for funds. Additionally, nonprice conditions and requirements (discussed below) affect a household=s demand for funds at every level of interest rates.

Businesses often finance investments in long-term (fixed) assets (e.g., plant and equipment) and in short-term assets (e.g., inventory and accounts receivable) with debt and other financial instruments. When interest rates are high (i.e., the cost of loanable funds is high), businesses prefer to finance investments with internally generated funds (e.g., retained earnings) rather than through borrowed funds. Further, the greater the number of profitable projects available to businesses, or the better the overall economic conditions, the greater the demand for loanable funds.

Governments also borrow heavily in financial markets. State and local governments often issue debt to finance temporary imbalances between operating revenues (e.g., taxes) and budgeted expenditures (e.g., road improvements, school construction). Higher interest rates cause state and local governments to postpone such capital expenditures. Similar to households and businesses, state and local governments' demand for funds vary with general economic conditions. The federal government is also a large borrower partly to finance current budget deficits (expenditures greater than taxes) and partly to finance past deficits. In contrast to other demanders of funds, the federal government's borrowing is not influenced by the level of interest rates. Expenditures in the federal government's budget are spent regardless of the interest cost.

Finally, foreign participants might also borrow in U.S. financial markets. Foreign borrowers look for the cheapest source of funds globally. Most foreign borrowing in U.S. financial markets comes from the business sector. In addition to interest costs, foreign borrowers consider nonprice terms on loanable funds as well as economic conditions in the home country.

3. Factors that affect the supply of funds include total wealth, risk of the financial security, future spending needs, monetary policy objectives, and economic conditions.

Wealth. As the total wealth of financial market participants (households, business, etc.) increases the absolute dollar value available for investment purposes increases. Accordingly, at every interest rate the supply of loanable funds increases, or the supply curve shifts down and to the right. The shift in the supply curve creates a disequilibrium in this financial market. As competitive forces adjust, and holding all other factors constant, the increase in the supply of funds due to an increase in the total wealth of market participants results in a decrease in the equilibrium interest rate, and an increase in the equilibrium quantity of funds traded.

Conversely, as the total wealth of financial market participants decreases the absolute dollar value available for investment purposes decreases. Accordingly, at every interest rate the supply of loanable funds decreases, or the supply curve shifts up and to the left. The shift in the supply curve again creates a disequilibrium in this financial market. As competitive forces adjust, and holding all other factors constant, the decrease in the supply of funds due to a decrease in the total wealth of market participants results in an increase in the equilibrium interest rate, and a decrease in the equilibrium quantity of funds traded.

Risk. As the risk of a financial security decreases, it becomes more attractive to supplier of funds. Accordingly, at every interest rate the supply of loanable funds increases, or the supply curve shifts down and to the right. The shift in the supply curve creates a disequilibrium in this financial market. As competitive forces adjust, and holding all other factors constant, the increase in the supply of funds due to a decrease in the risk of the financial security results in a decrease in the equilibrium interest rate, and an increase in the equilibrium quantity of funds traded.

Conversely, as the risk of a financial security increases, it becomes less attractive to supplier of funds. Accordingly, at every interest rate the supply of loanable funds decreases, or the supply curve shifts up and to the left. The shift in the supply curve creates a disequilibrium in this financial market. As competitive forces adjust, and holding all other factors constant, the decrease in the supply of funds due to an increase in the financial security's risk results in an increase in the equilibrium interest rate, and a decrease in the equilibrium quantity of funds traded.

Near-term Spending Needs. When financial market participants have few near-term spending needs, the absolute dollar value of funds available to invest increases. Accordingly, at every interest rate the supply of loanable funds increases, or the supply curve shifts down and to the right. The financial market, holding all other factors constant, reacts to this increased supply of funds by decreasing the equilibrium interest rate, and increasing the equilibrium quantity of funds traded.

Conversely, when financial market participants have near-term spending needs, the absolute dollar value of funds available to invest decreases. At every interest rate the supply of loanable funds decreases, or the supply curve shifts up and to the left. The shift in the supply curve creates a disequilibrium in this financial market that, when corrected results in an increase in the equilibrium interest rate, and a decrease in the equilibrium quantity of funds traded.

Monetary Expansion. One method used by the Federal Reserve to implement monetary policy is to alter the availability of credit and thus, the growth in the money supply. When monetary policy objectives are to enhance growth in the economy, the Federal Reserve increases the supply of funds available in the financial markets. At every interest rate the supply of loanable funds increases, the supply curve shifts down and to the right, and the equilibrium interest rate falls, while the equilibrium quantity of funds traded increases.

Conversely, when monetary policy objectives are to contract economic growth, the Federal Reserve decreases the supply of funds available in the financial markets. At every interest rate the supply of loanable funds decreases, the supply curve shifts up and to the left, and the equilibrium interest rate rises, while the equilibrium quantity of funds traded decreases.

Economic Conditions. Finally, as economic conditions improve in a country relative to other countries, the flow of funds to that country increases. The inflow of foreign funds to U.S. financial markets increases the supply of loanable funds at every interest rate and the supply curve shifts down and to the right. Accordingly, the equilibrium interest rate falls, and the equilibrium quantity of funds traded increases.

Conversely, when economic conditions in foreign countries improve, domestic and foreign investors take their funds out of domestic financial markets (e.g., the United States) and invest abroad. Thus, the supply of funds available in the financial markets decreases and the equilibrium interest rate rises, while the equilibrium quantity of funds traded decreases.

4. Factors that affect the demand for funds utility derived from the asset purchased with borrowed funds, restrictiveness of nonprice conditions of borrowing, domestic economic conditions, and foreign economic conditions.

Utility Derived from Asset Purchased With Borrowed Funds. As the utility derived from an asset purchased with borrowed funds increases the willingness of market participants (households, business, etc.) to borrow increases and the absolute dollar value borrowed increases. Accordingly, at every interest rate the demand for loanable funds increases, or the demand curve shifts up and to the right. The shift in the demand curve creates a disequilibrium in this financial market. As competitive forces adjust, and holding all other factors constant, the increase in the demand for funds due to an increase in the utility from the purchased asset results in an increase in the equilibrium interest rate, and an increase in the equilibrium quantity of funds traded.

Conversely, as the utility derived from an asset purchased with borrowed funds decreases the willingness of market participants (households, business, etc.) to borrow decreases and the absolute dollar value borrowed decreases. Accordingly, at every interest rate the demand of loanable funds decreases, or the demand curve shifts down and to the left. The shift in the demand curve again creates a disequilibrium in this financial market. As competitive forces adjust, and holding all other factors constant, the decrease in the demand for funds due to a decrease in the utility from the purchased asset results in a decrease in the equilibrium interest rate, and a decrease in the equilibrium quantity of funds traded.

Restrictiveness on Nonprice Conditions on Borrowed Funds. As the nonprice restrictions put on borrowers as a condition of borrowing decrease the willingness of market participants to borrow increases and the absolute dollar value borrowed increases. Accordingly, at every interest rate the demand of loanable funds increases, or the demand curve shifts up and to the right. The shift in the demand curve again creates a disequilibrium in this financial market. As competitive forces adjust, and holding all other factors constant, the increase in the demand for funds due to a decrease in the restrictive conditions on the borrowed funds results in an increase in the equilibrium interest rate, and an increase in the equilibrium quantity of funds traded.

Conversely, as the nonprice restrictions put on borrowers as a condition of borrowing increase market participants willingness to borrow decreases and the absolute dollar value borrowed decreases. Accordingly, at every interest rate the demand for loanable funds decreases, or the demand curve shifts down and to the left. The shift in the demand curve results in a decrease in the equilibrium interest rate, and a decrease in the equilibrium quantity of funds traded.

Economic Conditions. When the domestic economy is experiencing a period of growth, market participants are willing to borrow more heavily. Accordingly, at every interest rate the demand of loanable funds increases, or the demand curve shifts up and to the right. As competitive forces adjust, and holding all other factors constant, the increase in the demand for funds due to economic growth results in an increase in the equilibrium interest rate, and an increase in the equilibrium quantity of funds traded.

Conversely, when economic growth is stagnant market participants reduce their borrowings increases. Accordingly, at every interest rate the demand for loanable funds decreases, or the demand curve shifts down and to the left. The shift in the demand curve results in a decrease in the equilibrium interest rate, and a decrease in the equilibrium quantity of funds traded.

5. Specific factors that affect the nominal interest rate on any particular security include: inflation, the real risk-free rate, default risk, liquidity risk, special features regarding the use of funds raised by a particular security issuer, and the security's term to maturity.

6. The nominal interest rate on a security reflects its relative liquidity, with highly liquid assets carrying the lowest interest rates (all other characteristics remaining the same). Likewise, if a security is illiquid, investors add a liquidity risk premium (LRP) to the interest rate on the security.

7. Explanations for the yield curve's shape fall predominantly into three categories: the unbiased expectations theory, the liquidity premium theory, and the market segmentation theory.

According to the unbiased expectations theory of the term structure of interest rates, at any given point in time, the yield curve reflects the *market's current expectations of future short-term rates*. The second popular explanation―the liquidity premium theory of the term structure of interest rates—builds on the unbiased expectations theory. The liquidity premium idea is as follows: investors will hold long-term maturities only if these securities with longer term maturities are offered at a premium to compensate for future uncertainty in the security's value. The liquidity premium theory states that long-term rates are equal to geometric averages of current and expected short-term rates (like the unbiased expectations theory), plus liquidity risk premiums that increase with the security's maturity (this is the extension of the liquidity premium added to the unbiased expectations theory). The market segmentation theory does not build on the unbiased expectations theory or the liquidity premium theory, but rather argues that individual investors and FIs have specific maturity preferences, and convincing them to hold securities with maturities other than their most preferred requires a higher interest rate (maturity premium). The main thrust of the market segmentation theory is that investors do not consider securities with different maturities as perfect substitutes. Rather, individual investors and FIs have distinctly preferred investment horizons dictated by the dates when their liabilities will come due.

8. According to the unbiased expectations theory, the one-year interest rate one year from now is expected to be less than the one-year interest rate today.

9. The liquidity premium theory is an extension of the unbiased expectations theory. It based on the idea that investors will hold long-term maturities only if they are offered at a premium to compensate for future uncertainty in a security's value, which increases with an asset's maturity. Specifically, in a world of uncertainty, short-term securities provide greater marketability (due to their more active secondary market) and have less price risk (due to smaller price fluctuations for a given change in interest rates) than long-term securities. As a result, investors prefer to hold shorter term securities because they can be converted into cash with little risk of a loss of capital, i.e., short-term securities are more liquid. Thus, investors must be offered a liquidity premium to get them to but longer term securities. The liquidity premium theory states that long-term rates are equal to geometric averages of current and expected short-term rates (as under the unbiased expectations theory), plus liquidity risk premiums that increase with the maturity of the security. For example, according to the liquidity premium theory, an upward-sloping yield curve may reflect investor' expectations that future short-term rates will be flat, but because liquidity premiums increase with maturity, the yield curve will nevertheless be upward sloping.

10. A forward rate is an expected or implied rate on a short-term security that will originate at some point in the future.

11. The present value of an investment decreases as interest rates increase. Also as interest rates increase, present values decrease at a decreasing rate. This is because as interest rates increase, fewer funds need to be invested at the beginning of an investment horizon to receive a stated amount at the end of the investment horizon. This inverse relationship between the value of a financial instrument—for example, a bond—and interest rates is one of the most fundamental relationships in finance and is evident in the swings that occur in financial asset prices whenever major changes in interest rates arise. Further, because of the compounding of interest rates, the inverse relationship between interest rates and the present value of security investments is neither linear nor proportional.

Problems:

1. The fair interest rate on a financial security is calculated as

$$i^* \;=\; IP \;+\; RFR + DRP + LRP \;+ SCP + MP$$
$$8\% = 1.75\% + 3.5\% + DRP + 0.25\% + 0\% + 0.85\%$$

Thus, DRP = 8% - 1.75% - 3.5% - 0.25% - 0% - 0.85% = 1.65%

2. a. IP = i* – RFR = 3.25% - 2.25% = 1.00%

b. i_j^* = 1.00% + 2.25% + 1.15% + 0.50% + 1.75% = 6.65%

3. 8.00% = 1.75% + 3.50% + DRP + 0.25% + 0.85%
=> DRP = 8.00% - (1.75% + 3.50% + 0.25% + 0.85%) = 1.65%

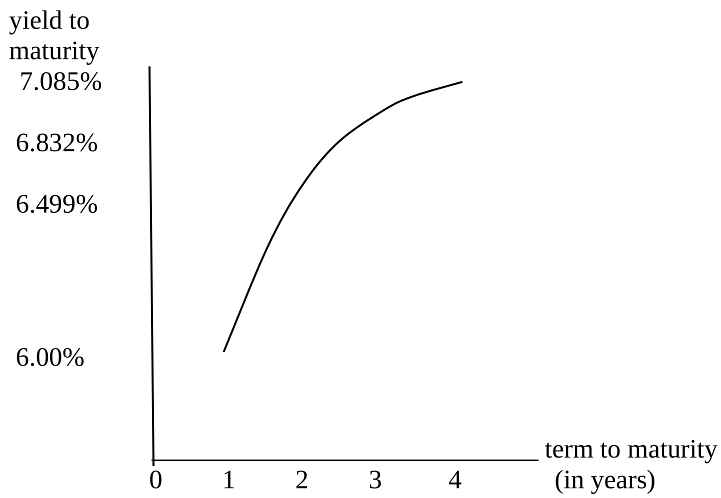
4. 1.94% = 0.50% + 1.00% + 0.00% + 0.00% + MP
=> MP = 1.94% - (0.50% + 1.00% + 0.00% + 0.00%) = 0.44%

5. 8.25% = 2.25% + 3.50% + 0.80 + LRP + (0.75% + (0.04% × 10))
=> LRP = 8.25% - (2.25% + 3.50% + 0.80% + (0.75% + (0.04% × 10))) = 0.55%

6. 6.05% = 1.00% + 2.10% + DRP + 0.25% + (0.10% + (0.05% × 8))
=> DRP = 6.05% - (1.00% + 2.10% + 0.25% + (0.10% + (0.05% × 8))) = 2.20%

7. ${}_1R_2 = [(1 + 0.052)(1 + 0.058)]^{1/2} - 1 = 5.50\%$

8. ${}_1R_1 = 6\%$
${}_1R_2 = [(1 + 0.06)(1 + 0.07)]^{1/2} - 1 = 6.499\%$
${}_1R_3 = [(1 + 0.06)(1 + 0.07)(1 + 0.075)]^{1/3} - 1 = 6.832\%$
${}_1R_4 = [(1 + 0.06)(1 + 0.07)(1 + 0.075)(1 + 0.0785)]^{1/4} - 1 = 7.085\%$



9. ${}_1R_2 = [(1 + 0.0345)(1 + 0.0365)]^{1/2} - 1 = 3.55\%$

10. $1 + {}_1R_2 = \{(1 + {}_1R_1)(1 + E({}_2r_1))\}^{1/2}$
$1.10 = \{1.08(1 + E({}_2r_1))\}^{1/2}$
$1.21 = 1.08\,(1 + E({}_2r_1))$
$1.21/1.08 = 1 + E({}_2r_1)$

$1 + E({}_2r_1) = 1.1204$
$E({}_2r_1) = 0.1204 = 12.04\%$

11. $1.12 = \{(1 + {}_1R_1)(1 + E({}_2r_1))(1 + E({}_3r_1))\}^{1/3}$
$1.12 = \{(1 + {}_1R_1)(1.08)(1.10)\}^{1/3}$
$1.4049 = (1 + {}_1R_1)(1.08)(1.10)$
$1 + {}_1R_1 = 1.4049/\{(1.08)(1.10)\}$
${}_1R_1 = 0.1826 = 18.26\%$

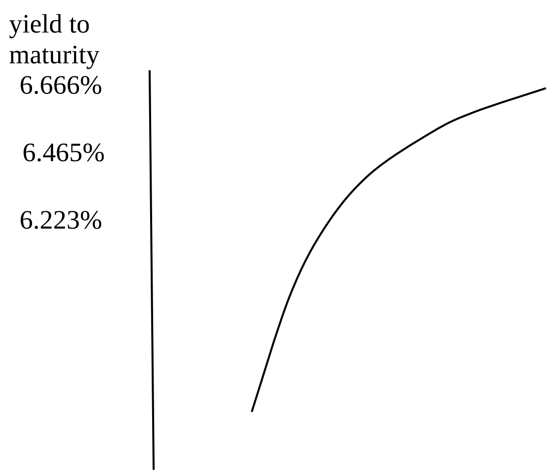
12. $1 + {}_1R_5 = \{(1 + {}_1R_4)^4(1 + E({}_5r_1))\}^{1/5}$
$1.0615 = \{(1.056)^4(1 + E({}_5r_1))\}^{1/5}$
$(1.0615)^5 = (1.056)^4\,(1 + E({}_5r_1))$
$(1.0615)^5/(1.056)^4 = 1 + E({}_5r_1)$
$1 + E({}_5r_1) = 1.08379$
$E({}_5r_1) = 8.379\%$

13. $1 + {}_1R_4 = \{(1 + {}_1R_3)^3(1 + E({}_4r_1))\}^{1/4}$
$1.026 = \{(1.0225)^3(1 + E({}_4r_1))\}^{1/4}$
$(1.026)^4 = (1.0225)^3(1 + E({}_4r_1))$
$(1.026)^4/(1.0225)^3 = 1 + E({}_4r_1)$
$1 + E({}_4r_1) = 1.03657$
$E({}_4r_1) = 3.657\%$

$1 + {}_1R_5 = \{(1 + {}_1R_4)^4(1 + E({}_5r_1))\}^{1/5}$
$1.0298 = \{(1.026)^4(1 + E({}_5r_1))\}^{1/5}$
$(1.0298)^5 = (1.026)^4\,(1 + E({}_5r_1))$
$(1.0298)^5/(1.026)^4 = 1 + E({}_5r_1)$
$1 + E({}_5r_1) = 1.04514$
$E({}_5r_1) = 4.514\%$

$1 + {}_1R_6 = \{(1 + {}_1R_5)^5(1 + E({}_6r_1))\}^{1/6}$
$1.0325 = \{(1.0298)^5(1 + E({}_6r_1))\}^{1/6}$
$(1.0325)^6 = (1.0298)^5(1 + E({}_6r_1))$
$(1.0325)^6/(1.0298)^5 = 1 + E({}_6r_1)$
$1 + E({}_6r_1) = 1.04611$
$E({}_6r_1) = 4.611\%$

14. ${}_1R_1 = 5.65\%$
${}_1R_2 = [(1 + 0.0565)(1 + 0.0675 + 0.0005)]^{1/2} - 1 = 6.223\%$
${}_1R_3 = [(1 + 0.0565)(1 + 0.0675 + 0.0005)(1 + 0.0685 + 0.0010)]^{1/3} - 1 = 6.465\%$
${}_1R_4 = [(1 + 0.0565)(1 + 0.0675 + 0.0005)(1 + 0.0685 + 0.0010)(1 + 0.0715 + 0.0012)]^{1/4} - 1 = 6.666\%$



5.65%

term to maturity
0 1 2 3 4 (in years)

15. $(1 + {}_1R_2) = \{(1 + {}_1R_1)(1 + E({}_2r_1) + L_2)\}^{1/2}$
$1.14 = \{1.10 \times (1 + 0.18 + L_2)\}^{1/2}$
$1.2996 = 1.10 \times (1 + 0.18 + L_2)$
$1.2996/1.10 = 1 + 0.18 + L_2$
$1.18145 = 1 + 0.18 + L_2$
$L_2 = 0.00145 = 0.145\%$

16. $1 + {}_1R_4 = \{(1 + {}_1R_3)(1 + E({}_4r_1) + L_4)\}^{1/4}$
$1.0550 = \{(1.0525)^3(1 + 0.0610 + L_4)\}^{1/4}$
$(1.0550)^4 = (1.0525)^3(1 + 0.0610 + L_4)$
$(1.0550)^4/(1.0525)^3 = 1 + 0.0610 + L_4$
$(1.0550)^4/(1.0525)^3 - 1.0610 = L_4 = .001536 = 0.1536\%$

17. ${}_1R_2 = 0.065 = [(1 + 0.055)(1 + {}_2f_1)]^{1/2} - 1$
$\Rightarrow [(1.065)^2/(1.055)] - 1 = {}_2f_1 = 7.51\%$

18. ${}_1R_3 = 0.09 = [(1 + 0.065)^2(1 + {}_3f_1)]^{1/3} - 1$
$\Rightarrow [(1.09)^3/(1.065)^2)] - 1 = {}_3f_1 = 14.18\%$

19. ${}_2f_1 = [(1 + {}_1R_2)^2/(1 + {}_1R_1)] - 1 = [(1 + 0.0495)^2/(1 + 0.0475)] - 1 = 5.15\%$
${}_3f_1 = [(1 + {}_1R_3)^3/(1 + {}_1R_2)^2] - 1 = [(1 + 0.0525)^3/(1 + 0.0495)^2] - 1 = 5.85\%$
${}_4f_1 = [(1 + {}_1R_4)^4/(1 + {}_1R_3)^3] - 1 = [(1 + 0.0565)^4/(1 + 0.0525)^3] - 1 = 6.86\%$

20. ${}_4f_1 = [(1 + {}_1R_4)^4/(1 + {}_1R_3)^3] - 1 = [(1 + 0.0635)^4/(1 + 0.06)^3] - 1 = 7.41\%$
${}_5f_1 = [(1 + {}_1R_5)^5/(1 + {}_1R_4)^4] - 1 = [(1 + 0.0665)^5/(1 + 0.0635)^4] - 1 = 7.86\%$
${}_6f_1 = [(1 + {}_1R_6)^6/(1 + {}_1R_5)^5] - 1 = [(1 + 0.0675)^6/(1 + 0.0665)^5] - 1 = 7.25\%$

21. ${}_1R_1 = 4.5\%$
${}_1R_2 = 5.25\% = [(1 + 0.045)(1 + {}_2f_1)]^{1/2} - 1 \Rightarrow {}_2f_1 = 6.01\%$
${}_1R_3 = 6.50\% = [(1 + 0.045)(1 + 0.0601)(1 + {}_3f_1)]^{1/3} - 1 \Rightarrow {}_3f_1 = 9.04\%$

22. a. $PV = \$5,000/(1+0.06)^5 = \$5,000\ (0.747258) = \$3,736.29$
b. $PV = \$5,000/(1+0.08)^5 = \$5,000\ (0.680583) = \$3,402.92$
c. $PV = \$5,000/(1+0.10)^5 = \$5,000\ (0.620921) = \$3,104.61$
d. $PV = \$5,000/(1+0.05)^{10} = \$5,000\ (0.613913) = \$3,069.57$
e. $PV = \$5,000/(1+0.025)^{20} = \$5,000\ (0.610271) = \$3,051.35$

From these answers we see that the present values of a security investment decrease as interest rates increase. As rates rose from 6 percent to 8 percent, the (present) value of the security investment fell $333.37 (from $3,736.29 to $3,402.92). As interest rates rose from 8 percent to 10 percent, the value of the investment fell $298.31 (from $3,402.92 to $3,104.61). This is because as interest rates increase, fewer funds need to be invested at the beginning of an investment horizon to receive a stated amount at the end of the investment horizon. Also, as interest rates increase, the present values of the investment decrease at a decreasing rate. The fall in present value is greater when interest rates rise from 6 percent to 8 percent compared to when they rise from 8 percent to 10 percent. The inverse relationship between interest rates and the present value of security investments is neither linear nor proportional.

From the above answers, we also see that the greater the number of compounding periods per year, the smaller the present value of a future amount. This is because, the greater the number of compounding periods the more frequently interest is paid and thus, a greater amount of interest that is paid. Thus, to get to a stated amount at the end of an investment horizon, the greater the amount that will come from interest and the less the amount the investor must pay up front.

23. a. FV = $5,000 $(1+0.06)^5$ = $5,000 (1.338226) = $6,691.13
    b. FV = $5,000 $(1+0.08)^5$ = $5,000 (1.469328) = $7,346.64
    c. FV = $5,000 $(1+0.10)^5$ = $5,000 (1.610510) = $8,052.55
    d. FV = $5,000 $(1+0.05)^{10}$ = $5,000 (1.628895) = $8,144.47
    e. FV = $5,000 $(1+0.025)^{20}$ = $5,000 (1.638616) = $8,193.08

From these answers we see that the future values of a security investment increase as interest rates increase. As rates rose from 6 percent to 8 percent, the (future) value of the security investment rose to $655.51 (from $6,691.13 to $7,346.). As interest rates rose from 8 percent to 10 percent, the value of the investment rose to $705.91 (from $7,346.64 to $8,052.55). This is because as interest rates increase, a stated amount of funds invested at the beginning of an investment horizon accumulates to a larger amount at the end of the investment horizon. Also as interest rates increase, the future values of the investment increase at an increasing rate. The rise in present value is greater when interest rates rise from 8 percent to 10 percent compared to when they rise from 6 percent to 8 percent. The positive relationship between interest rates and the future value of security investments is neither linear nor proportional. From the above answers, we also see that the greater the number of compounding periods per year, the greater the future value of a future amount. This is because, the greater the number of compounding periods the more frequently interest is paid and thus, a greater amount of interest that is paid. The greater the amount of interest paid and the greater the future value of a present amount.

24. a. PV = $5,000{[1 - (1/$(1 + 0.06)^5$)]/0.06} = $5,000 (4.212364) = $21,061.82
    b. PV = $5,000{[1 - (1/$(1 + 0.015)^{20}$)]/0.015} = $5,000 (17.168639) = $85,843.19
    c. PV = $5,000{[1 - (1/$(1 + 0.06)^5$)]/0.06}(1 + .06) = $5,000 (4.212364)(1 + .06) = $22,325.53
    d. PV = $5,000{[1 - (1/$(1 + 0.015)^{20}$)]/0.015}(1 + .015) = $5,000 (17.168639)(1.015) = $87,130.84

25. a. FV = $5,000{[$(1 + 0.06)^5$ -1]/0.06} = $5,000 (5.637092) = $28,185.46
    b. FV = $5,000{[$(1 + 0.015)^{20}$ -1]/0.015} = $5,000 (23.123667) = $115,618.34
    c. FV = $5,000{[$(1 + 0.06)^5$ -1]/0.06}(1 + 0.06) = $5,000 (5.637092)(1 + .06) = $29,876.59
    d. FV = $5,000{[$(1 + 0.015)^{20}$ -1]/0.015}(1 + 0.015) = $5,000 (23.123667)(1.015) = $117,352.61

26. FV = $123{[$(1 + 0.13)^{13}$ -1]/0.13} = $3,688.12
    FV = $123{[$(1 + 0.13)^{13}$ -1]/0.13} (1 + 0.13/1) = $4,167.57

    FV = $4,555{[$(1 + 0.08)^8$ - 1]/0.08} = $48,449.84
    FV = $4,555{[$(1 + 0.08)^8$ - 1]/0.08}(1 + 0.08/1) = $52,325.83

    FV = $74,484{[$(1+0.10)^5$-1]/0.10} = $454,732.27
    FV = $74,484{[$(1+0.10)^5$-1]/0.10(1 + 0.10/1) = $500,205.50

    FV = $167,332{[$(1 + 0.01)^9$ - 1]/0.01} = $1,567,654.40
    FV = $167,332{[$(1 + 0.01)^9$ - 1]/0.01}(1 + 0.01/1) = $1,583,330.95

27. PV = $678.09{[1 - (1/$(1 + 0.13)^7$)]/0.13} = $2,998.93
    PV = $678.09{[1 - (1/$(1 + 0.13)^7$)]/0.13}(1 + 0.13/1) = $3,388.79

    PV = $7,968.26{[1 - (1/$(1 + 0.06)^{13}$)]/0.06} = $70,540.48
    PV = $7,968.26{[1 - (1/$(1 + 0.06)^{13}$)]/0.06}(1 + 0.06/1) = $74,772.91

    PV = $20,322.93{[1 - (1/$(1 + 0.04)^{23}$)]/0.04} = $301,934.55
    PV = $20,322.93{[1 - (1/$(1 + 0.04)^{23}$)]/0.04}(1 + 0.04/1) = $314,011.94

    PV = $69,712.54{[1 - (1/$(1 + 0.31)^4$)]/0.31} = $148,519.49

PV = $69,712.54{[1 - (1/(1 + 0.31)^4)]/0.31}(1 + 0.31/1) = $194,560.54

28. FV = $500 (1.06)^3 = $595.51. So, the interest portion is $95.51 = $595.51 − $500.

29. PV = $2,000/(1.08)^4 = $1,470.06

30. PV = -$1,200 = $2,000/(1.075)^t
=> Using a financial calculator, I = 7.5, PV= -1,200, PMT = 0, FV = 2,000, then compute N = 7.06 years

31. FV = $1,000{[(1 + 0.10)^6 - 1]/0.10}(1 + 0.10) = $8,487.17
or using a financial calculator, N = 6, I = 10, PV = 0, PMT = -1,000, then compute FV = $7,715.61, then multiply $7,715.61 × (1+0.10) = $8,487.17.

32. PV = $180,000 = PMT{[1 - (1/(1 + 0.08/12)^{15x12})]/(0.08/12)} = $1,720.17
or using a financial calculator, N = 15x12 = 180, I = 8÷12 = .66667, PV = -180,000, FV = 0, then compute PMT = $1,720.17