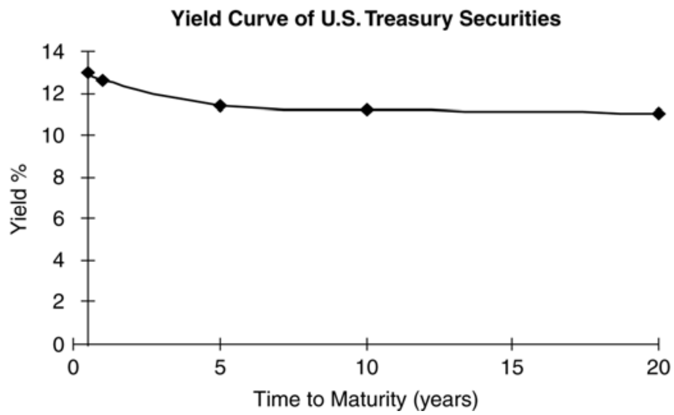
■ Solutions to Problems

P6-1. LG 1: Yield curve

Intermediate

a.

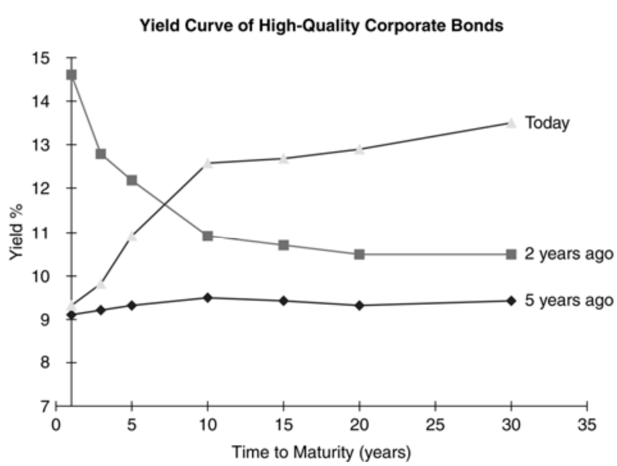


b. The yield curve is slightly downward sloping, reflecting lower expected future rates of interest. The curve may reflect a general expectation for an economic recovery due to inflation coming under control and a stimulating impact on the economy from the lower rates. However, a slowing economy may diminish the perceived need for funds and the resulting interest rate being paid for cash. Obviously, the second scenario is not good for business and highlights the challenge of forecasting the future based on the term structure of interest rates.

P6-2. LG 1: Term structure of interest rates

Intermediate

a.



b. and c.

Five years ago, the yield curve was relatively flat, reflecting expectations of stable interest rates and stable inflation. Two years ago, the yield curve was downward sloping, reflecting lower expected interest rates due to a decline in the expected level of inflation. Today, the yield curve is upward sloping, reflecting higher expected inflation and higher future rates of interest.

P6-3. LG 1: Risk-free rate and risk premiums

Basic

a. Risk-free rate: $R_F = r^* + IP$

Security	r^*	+	IP	=	R_F
A	3%	+	6%	=	9%
B	3%	+	9%	=	12%
C	3%	+	8%	=	11%
D	3%	+	5%	=	8%
E	3%	+	11%	=	14%

b. Since the expected inflation rates differ, it is probable that the maturity of each security differs.

c. Nominal rate: $r = r^* + IP + RP$

Security	r^*	+	IP	+	RP	=	r
A	3%	+	6%	+	3%	=	12%
B	3%	+	9%	+	2%	=	14%
C	3%	+	8%	+	2%	=	13%
D	3%	+	5%	+	4%	=	12%
E	3%	+	11%	+	1%	=	15%

P6-4. LG 1: Risk premiums

Intermediate

a. $R_{Ft} = r^* + \text{IP}_t$

Security A: $R_{F3} = 2\% + 9\% = 11\%$

Security B: $R_{F15} = 2\% + 7\% = 9\%$

b. Risk premium:

RP = default risk + maturity risk + liquidity risk + other risk

Security A: RP = 1% + 0.5% + 1% + 0.5% = 3%

Security B: RP = 2% + 1.5% + 1% + 1.5% = 6%

c. $r_i = r^* + \text{IP} + \text{RP}$ or $r_1 = r_F + \text{risk premium}$

Security A: $r_1 = 11\% + 3\% = 14\%$

Security B: $r_1 = 9\% + 6\% = 15\%$

Security A has a higher risk-free rate of return than Security B due to expectations of higher near-term inflation rates. The issue characteristics of Security A in comparison to Security B indicate that Security A is less risky.

P6-5. LG 2: Bond interest payments before and after taxes

Intermediate

a. Yearly interest = [($2,500,000/2500) × 0.07] = ($1,000 × 0.07) = $70.00

b. Total interest expense = $70.00 per bond × 2,500 bonds = $175,000

c.

Total before tax interest	$175,000
Interest expense tax savings (0.35 × $175,000)	61,250
Net after-tax interest expense	$113,750

P6-6. LG 4: Bond prices and yields

Basic

a. 0.97708 × $1,000 = $977.08

b. (0.05700 × $1,000) ÷ $977.08 = $57.000 ÷ $977.08 = 0.0583 = 5.83%

c. The bond is selling at a discount to its $1,000 par value.

d. The yield to maturity is higher than the current yield, because the former includes $22.92 in price appreciation between today and the May 15, 2017 bond maturity.

P6-7. LG 4: Personal finance: Valuation fundamentals

Basic

a.

Cash flows:	CF_{1-5}	$1,200
	CF_5	$5,000

Required return: 6%

b. $$V_0 = \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} + \frac{CF_4}{(1+r)^4} + \frac{CF_5}{(1+r)^5}$$

$$V_0 = \frac{\$1,200}{(1+0.06)^1} + \frac{\$1,200}{(1+0.06)^2} + \frac{\$1,200}{(1+0.06)^3} + \frac{\$1,200}{(1+0.06)^4} + \frac{\$6,200}{(1+0.06)^5}$$

$$V_0 = \$8,791$$

Using PVIF formula:

V_0 = [(CF_1 × $PVIF_{6\%,1}$) + (CF_2 × $PVIF_{6\%,2}$) · · · (CF_5 × $PVIF_{6\%,5}$)]

V_0 = [($1,200 × 0.943) + ($1,200 × 0.890) + ($1,200 × 0.840) + ($1,200 × 0.792)
+ ($6,200 × 0.747)]

V_0 = $1,131.60 + $1,068.00 + $1,008 + $950.40 + $4,631.40

V_0 = $8,789.40

Calculator solution: $8,791

The maximum price you should be willing to pay for the car is $8,789, since if you paid more than that amount, you would be receiving less than your required 6% return.

P6-8. LG 4: Valuation of assets

Basic

Asset	End of Year	Amount	PVIF or PVIFA$_{r\%,n}$	PV of Cash Flow
A	1	$ 5000		
	2	$ 5000	2.174	
	3	$ 5000		$10,870.00
			Calculator solution:	$10,871.36
B	1–∞	$ 300	1 ÷ 0.15	$ 2,000
C	1	0		
	2	0		
	3	0		
	4	0		
	5	$35,000	0.476	$16,660.00
			Calculator solution:	$16,663.96
D	1–5	$ 1,500	3.605	$ 5,407.50
	6	8,500	0.507	4,309.50
				$ 9,717.00
			Calculator solution:	$ 9,713.53
E	1	$ 2,000	0.877	$ 1,754.00
	2	3,000	0.769	2,307.00
	3	5,000	0.675	3,375.00
	4	7,000	0.592	4,144.00
	5	4,000	0.519	2,076.00
	6	1,000	0.456	456.00
				$14,112.00
			Calculator solution:	$14,115.27

P6-9. LG 4: Personal finance: Asset valuation and risk

Intermediate

a.

		10% Low Risk		15% Average Risk		22% High Risk	
		PVIFA	PV of CF	PVIFA	PV of CF	PVIFA	PV of CF
CF_{1-4}	$3,000	3.170	$ 9,510	2.855	$ 8,565	2.494	$ 7,482
CF_5	15,000	0.621	9,315	0.497	7,455	0.370	5,550
PV of CF:			$18,825		$16,020		$13,032
Calculator solutions:			$18,823.42		$16,022.59		$13,030.91

b. The maximum price Laura should pay is $13,032. Unable to assess the risk, Laura would use the most conservative price, therefore assuming the highest risk.

c. By increasing the risk of receiving cash flow from an asset, the required rate of return increases, which reduces the value of the asset.

P6-10. LG 5: Basic bond valuation

Intermediate

a. $B_0 = I \times (\text{PVIFA}_{rd\%,n}) + M \times (\text{PVIF}_{rd\%,n})$

$B_0 = 120 \times (\text{PVIFA}_{10\%,16}) + M \times (\text{PVIF}_{10\%,16})$

$B_0 = \$120 \times (7.824) + \$1{,}000 \times (0.218)$

$B_0 = \$938.88 + \$218$

$B_0 = \$1{,}156.88$

Calculator solution: $1,156.47

b. Since Complex Systems' bonds were issued, there may have been a shift in the supply-demand relationship for money or a change in the risk of the firm.

c. $B_0 = I \times (\text{PVIFA}_{rd\%,n}) + M \times (\text{PVIF}_{rd\%,n})$

$B_0 = 120 \times (\text{PVIFA}_{12\%,16}) + M \times (\text{PVIF}_{12\%,16})$

$B_0 = \$120 \times (6.974) + \$1{,}000 \times (0.163)$

$B_0 = \$836.88 + \$163$

$B_0 = \$999.88$

Calculator solution: $1,000

When the required return is equal to the coupon rate, the bond value is equal to the par value. In contrast to **a** above, if the required return is less than the coupon rate, the bond will sell at a premium (its value will be greater than par).

P6-11. LG 5: Bond valuation–annual interest

Basic

$B_0 = I \times (\text{PVIFA}_{rd\%,n}) + M \times (\text{PVIF}_{rd\%,n})$

Bond	Table Values	Calculator Solution
A	$B_0 = \$140 \times (7.469) + \$1{,}000 \times (0.104) = \$1{,}149.66$	$1,149.39
B	$B_0 = \$80 \times (8.851) + \$1{,}000 \times (0.292) = \$1{,}000.00$	$1,000.00
C	$B_0 = \$10 \times (4.799) + \$100 \times (0.376) = \$\ 85.59$	$ 85.60
D	$B_0 = \$80 \times (4.910) + \$500 \times (0.116) = \$\ 450.80$	$ 450.90
E	$B_0 = \$120 \times (6.145) + \$1{,}000 \times (0.386) = \$1{,}123.40$	$1,122.89

P6-12. LG 5: Bond value and changing required returns

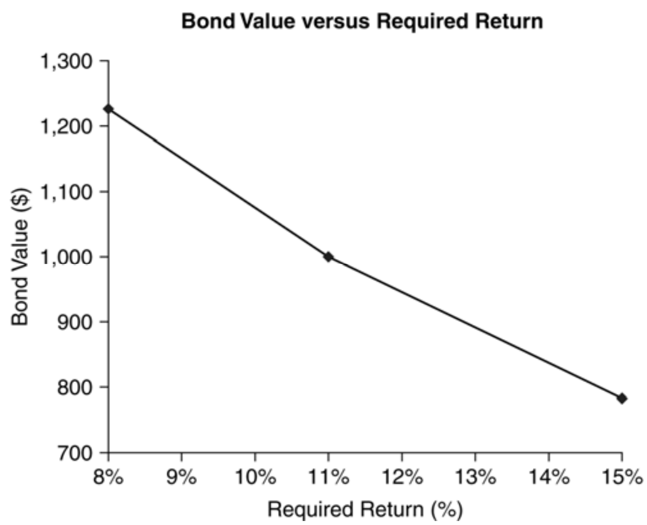
Intermediate

$B_0 = I \times (\text{PVIFA}_{rd\%,n}) + M \times (\text{PVIF}_{rd\%,n})$

a.

Bond	Table Values	Calculator Solution
1	B_0 = \$110 × (6.492) + \$1,000 × (0.286) = \$1,000.00	\$1,000.00
2	B_0 = \$110 × (5.421) + \$1,000 × (0.187) = \$ 783.31	\$ 783.18
3	B_0 = \$110 × (7.536) + \$1,000 × (0.397) = \$1,225.96	\$1,226.08

b.



c. When the required return is less than the coupon rate, the market value is greater than the par value and the bond sells at a premium. When the required return is greater than the coupon rate, the market value is less than the par value; the bond therefore sells at a discount.

d. The required return on the bond is likely to differ from the coupon interest rate because either (1) economic conditions have changed, causing a shift in the basic cost of long-term funds, or (2) the firm's risk has changed.

P6-13. LG 5: Bond value and time–constant required returns

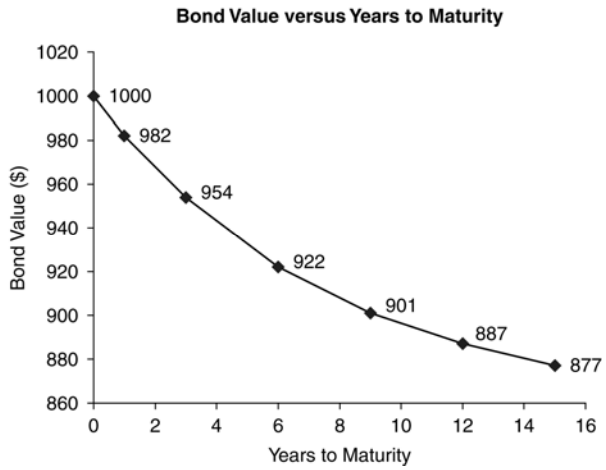
Intermediate

$B_0 = I \times (\text{PVIFA}_{rd\%,n}) + M \times (\text{PVIF}_{rd\%,n})$

a.

Bond	Table Values	Calculator Solution
1	B_0 = \$120 × (6.142) + \$1,000 × (0.140) = \$877.04	\$877.16
2	B_0 = \$120 × (5.660) + \$1,000 × (0.208) = \$887.20	\$886.79
3	B_0 = \$120 × (4.946) + \$1,000 × (0.308) = \$901.52	\$901.07
4	B_0 = \$120 × (3.889) + \$1,000 × (0.456) = \$922.68	\$922.23
5	B_0 = \$120 × (2.322) + \$1,000 × (0.675) = \$953.64	\$953.57
6	B_0 = \$120 × (0.877) + \$1,000 × (0.877) = \$982.24	\$982.46

b.



c. The bond value approaches the par value.

P6-14. LG 5: Personal finance: Bond value and time–changing required returns

Challenge

$B_0 = I \times (\text{PVIFA}_{rd\%,n}) + M \times (\text{PVIF}_{rd\%,n})$

a.

Bond	Table Values	Calculator Solution
1	B_0 = \$110 × (3.993) + \$1,000 × (0.681) = \$1,120.23	\$1,119.78
2	B_0 = \$110 × (3.696) + \$1,000 × (0.593) = \$1,000.00	\$1,000.00
3	B_0 = \$110 × (3.433) + \$1,000 × (0.519) = \$ 896.63	\$ 897.01

b.

Bond	Table Values	Calculator Solution
1	B_0 = \$110 × (8.560) + \$1,000 × (0.315) = \$1,256.60	\$1,256.78
2	B_0 = \$110 × (7.191) + \$1,000 × (0.209) = \$1,000.00	\$1,000.00
3	B_0 = \$110 × (6.142) + \$1,000 × (0.140) = \$ 815.62	\$ 815.73

c.

	Value	
Required Return	**Bond A**	**Bond B**
8%	\$1,120.23	\$1,256.60
11%	1,000.00	1,000.00
14%	896.63	815.62

The greater the length of time to maturity, the more responsive the market value of the bond to changing required returns, and vice versa.

d. If Lynn wants to minimize interest rate risk in the future, she would choose Bond A with the shorter maturity. Any change in interest rates will impact the market value of Bond A less than if she held Bond B.

P6-15. LG 6: Yield to maturity

Basic

Bond A is selling at a discount to par.
Bond B is selling at par value.
Bond C is selling at a premium to par.
Bond D is selling at a discount to par.
Bond E is selling at a premium to par.

P6-16. LG 6: Yield to maturity

Intermediate

a. Using a financial calculator the YTM is 12.685%. The correctness of this number is proven by putting the YTM in the bond valuation model. This proof is as follows:

$B_0 = 120 \times (\text{PVIFA}_{12.685\%,15}) + 1{,}000 \times (\text{PVIF}_{12.685\%,15})$

$B_0 = \$120 \times (6.569) + \$1{,}000 \times (0.167)$

$B_0 = \$788.28 + 167$

$B_0 = \$955.28$

Since B_0 is \$955.28 and the market value of the bond is \$955, the YTM is equal to the rate derived on the financial calculator.

b. The market value of the bond approaches its par value as the time to maturity declines. The yield to maturity approaches the coupon interest rate as the time to maturity declines.

P6-17. LG 6: Yield to maturity

Intermediate

a.

Bond	Approximate YTM	Trial-and-Error YTM Approach	Error (%)	Calculator Solution
A	$= \dfrac{\$90 + [(\$1{,}000 - \$820) \div 8]}{[(\$1{,}000 + \$820) \div 2]}$			
	= 12.36%	12.71%	–0.35	12.71%
B	= 12.00%	12.00%	0.00	12.00%
C	$= \dfrac{\$60 + [(\$500 - \$560) \div 12]}{[(\$500 + \$560) \div 2]}$			
	= 10.38%	10.22%	+0.15	10.22%
D	$= \dfrac{\$150 + [(\$1{,}000 - \$1{,}120) \div 10]}{[(\$1{,}000 + \$1{,}120 \div 2]}$			
	= 13.02%	12.81%	+0.21	12.81%
E	$= \dfrac{\$50 + [(\$1{,}000 - \$900) \div 3]}{[(\$1{,}000 + \$900) \div 2]}$			
	= 8.77%	8.94%	–0.017	8.95%

b. The market value of the bond approaches its par value as the time to maturity declines. The yield-to-maturity approaches the coupon interest rate as the time to maturity declines. Case B highlights the fact that if the current price equals the par value, the coupon interest rate equals the yield to maturity (regardless of the number of years to maturity).

P6-18. LG 6: Bond valuation–semiannual interest

Intermediate

$B_0 = I \times (\text{PVIFA}_{rd\%,n}) + M \times (\text{PVIF}_{rd\%,n})$
$B_0 = \$50 \times (\text{PVIFA}_{7\%,12}) + M \times (\text{PVIF}_{7\%,12})$
$B_0 = \$50 \times (7.943) + \$1,000 \times (0.444)$
$B_0 = \$397.15 + \$444$
$B_0 = \$841.15$

Calculator solution: $841.15

P6-19. LG 6: Bond valuation–semiannual interest

Intermediate

$B_0 = I \times (\text{PVIFA}_{rd\%,n}) + M \times (\text{PVIF}_{rd\%,n})$

Bond	Table Values	Calculator Solution
A	$B_0 = \$50 \times (15.247) + \$1,000 \times (0.390) = \$1,152.35$	$1,152.47
B	$B_0 = \$60 \times (15.046) + \$1,000 \times (0.097) = \$1,000.00$	$1,000.00
C	$B_0 = \$30 \times (7.024) + \$500 \times (0.508) = \$\ 464.72$	$ 464.88
D	$B_0 = \$70 \times (12.462) + \$1,000 \times (0.377) = \$1,249.34$	$1,249.24
E	$B_0 = \$3 \times (5.971) + \$100 \times (0.582) = \$\ 76.11$	$ 76.11

P6-20. LG 6: Bond valuation–quarterly interest

Challenge

$B_0 = I \times (\text{PVIFA}_{rd\%,n}) + M \times (\text{PVIF}_{rd\%,n})$
$B_0 = \$125 \times (\text{PVIFA}_{3\%,40}) + \$5,000 \times (\text{PVIF}_{3\%,40})$
$B_0 = \$125 \times (23.115) + \$5,000 \times (0.307)$
$B_0 = \$2,889.38 + \$1,535$
$B_0 = \$4,424.38$

Calculator solution: $4,422.13

P6-21. Ethics problem

Intermediate

Student answers will vary. Some students may argue that such a policy decreases the reliability of the rating agency's bond ratings since the rating is not purely based on the quantitative and nonquantitative factors that should be considered. One of the goals of the new law is to discourage such a practice. Other students may argue that, like a loss leader, ratings are a way to generate additional business for the rating firm.

■ Case

Evaluating Annie Hegg's Proposed Investment in Atilier Industries Bonds

This case demonstrates how a risky investment can affect a firm's value. First, students must calculate the current value of Atilier's bonds, rework the calculations assuming that the firm makes the risky investment, and then draw some conclusions about the value of the firm in this situation. In addition to gaining experience in valuation of bonds, students will see the relationship between risk and valuation.

1. Annie should convert the bonds. The value of the stock if the bond is converted is:

   50 shares × \$30 per share = \$1,500
   while if the bond was allowed to be called in the value would be on \$1,080

2. Current value of bond under different required returns – annual interest

   a. $B_0 = I \times (\text{PVIFA}_{6\%,25\text{ yrs.}}) + M \times (\text{PVIF}_{6\%,25\text{ yrs.}})$
   $B_0 = \$80 \times (12.783) + \$1{,}000 \times (0.233)$
   $B_0 = \$1{,}022.64 + \$233$
   $B_0 = \$1{,}255.64$
   Calculator solution: \$1,255.67
   The bond would be at a premium.

   b. $B_0 = I \times (\text{PVIFA}_{8\%,25\text{ yrs.}}) + M \times (\text{PVIF}_{8\%,25\text{ yrs.}})$
   $B_0 = \$80 \times (10.674) + \$1{,}000 \times (0.146)$
   $B_0 = \$853.92 + \$146$
   $B_0 = \$999.92$
   Calculator solution: \$1,000.00
   The bond would be at par value.

   c. $B_0 = I \times (\text{PVIFA}_{10\%,25\text{ yrs.}}) + M \times (\text{PVIF}_{10\%,25\text{ yrs.}})$
   $B_0 = \$80 \times (9.077) + \$1{,}000 \times (0.092)$
   $B_0 = \$726.16 + \$92$
   $B_0 = \$818.16$
   Calculator solution: \$818.46
   The bond would be at a discount.

3. Current value of bond under different required returns – semiannual interest

   a. $B_0 = I \times (\text{PVIFA}_{3\%,50\text{ yrs.}}) + M \times (\text{PVIF}_{3\%,50\text{ yrs.}})$
   $B_0 = \$40 \times (25.730) + \$1{,}000 \times (0.228)$
   $B_0 = \$1{,}029.20 + \$228$
   $B_0 = \$1{,}257.20$
   Calculator solution: \$1,257.30
   The bond would be at a premium.

b. $B_0 = I \times (\text{PVIFA}_{4\%,50\text{ yrs.}}) + M \times (\text{PVI}_{4\%,50\text{ yrs.}})$
$B_0 = \$40 \times (21.482) + \$1{,}000 \times (0.141)$
$B_0 = \$859.28 + \$146$
$B_0 = \$1005.28$
Calculator solution: $1,000.00
The bond would be at par value.

c. $B_0 = I \times (\text{PVIFA}_{5\%,50\text{ yrs.}}) + M \times (\text{PVIF}_{5\%,50\text{ yrs.}})$
$B_0 = \$40 \times (18.256) + \$1{,}000 \times (0.087)$
$B_0 = \$730.24 + \$87$
$B_0 = \$817.24$
Calculator solution: $817.44
The bond would be at a discount.

Under all three required returns for both annual and semiannual interest payments the bonds are consistent in their direction of pricing. When the required return is above (below) the coupon the bond sells at a discount (premium). When the required return and coupon are equal the bond sells at par. When the change is made from annual to semiannual payments the value of the premium and par value bonds increase while the value of the discount bond decreases. This difference is due to the higher effective return associated with compounding frequency more often than annual.

4. If expected inflation increases by 1% the required return will increase from 8% to 9%, and the bond price would drop to $901.84. This amount is the maximum Annie should pay for the bond.
$B_0 = I \times (\text{PVIFA}_{9\%,25\text{ yrs.}}) + M \times (\text{PVIF}_{9\%,25\text{ yrs.}})$
$B_0 = \$80 \times (9.823) + \$1{,}000 \times (0.116)$
$B_0 = \$785.84 + \$116$
$B_0 = \$901.84$
Calculator solution: $901.77

5. The value of the bond would decline to $925.00 due to the higher required return and the inverse relationship between bond yields and bond values.
$B_0 = I \times (\text{PVIFA}_{8.75\%,25\text{ yrs.}}) + M \times (\text{PVIF}_{8.75\%,25\text{ yrs.}})$
$B_0 = \$80 \times (10.025) + \$1{,}000 \times (0.123)$
$B_0 = \$802.00 + \$123$
$B_0 = \$925.00$
Calculator solution: $924.81

6. The bond would increase in value and a gain of $110.88 would be earned by Annie.
Bond value at 7% and 22 years to maturity.
$B_0 = I \times (\text{PVIFA}_{7\%,22\text{ yrs.}}) + M \times (\text{PVIF}_{7\%,22\text{ yrs.}})$
$B_0 = \$80 \times (11.061) + \$1{,}000 \times (0.226)$
$B_0 = \$884.88 + \$226$
$B_0 = \$1{,}110.88$
Calculator solution: $1,110.61

7. The bond would increase in value and a gain of $90.64 would be earned by Annie.

   Bond value at 7% and 15 years to maturity.

   $B_0 = I \times (\text{PVIFA}_{7\%,15\text{ yrs.}}) + M \times (\text{PVIF}_{7\%,15\text{ yrs.}})$

   $B_0 = \$80 \times (9.108) + \$1{,}000 \times (0.362)$

   $B_0 = \$728.64 + \$362$

   $B_0 = \$1{,}090.64$

   Calculator solution: $1,091.08

   The bond is more sensitive to interest rate changes when the time to maturity is longer (22 years) than when the time to maturity is shorter (15 years). Maturity risk decreases as the bond gets closer to maturity.

8. Antilier Industries provides a yield of 8% ($80), and is priced at $983.80 (0.98380 × 1000). Hence, the current yield is 80/983.80 = .0813 or about 8.13% of par. Using the calculator the YTM on this bond assuming annual interest payments of $80, 25 years to maturity, and a current price of $983.80 would be 8.15%.

9. Annie should probably not invest in the Atilier bond. There are several reasons for this conclusion.
   a. The term to maturity is long and thus the maturity risk is high.
   b. An increase in interest rates is likely due to the potential downgrading of the bond thus driving the price down.
   c. An increase in interest rates is likely due to the possibility of higher inflation thus driving the price down.
   d. The price of $983.75 is well above her minimum price of $901.84 assuming an increase in interest rates of 1%.

■ Spreadsheet Exercise

The answer to Chapter 6's CSM Corporation spreadsheet problem is located in the Instructor's Resource Center at *www.prenhall.com/irc*.

■ A Note on Web Exercises

A series of chapter-relevant assignments requiring Internet access can be found at the book's Companion Website at *http://www.prenhall.com/gitman*. In the course of completing the assignments students access information about a firm, its industry, and the macro economy, and conduct analyses consistent with those found in each respective chapter.