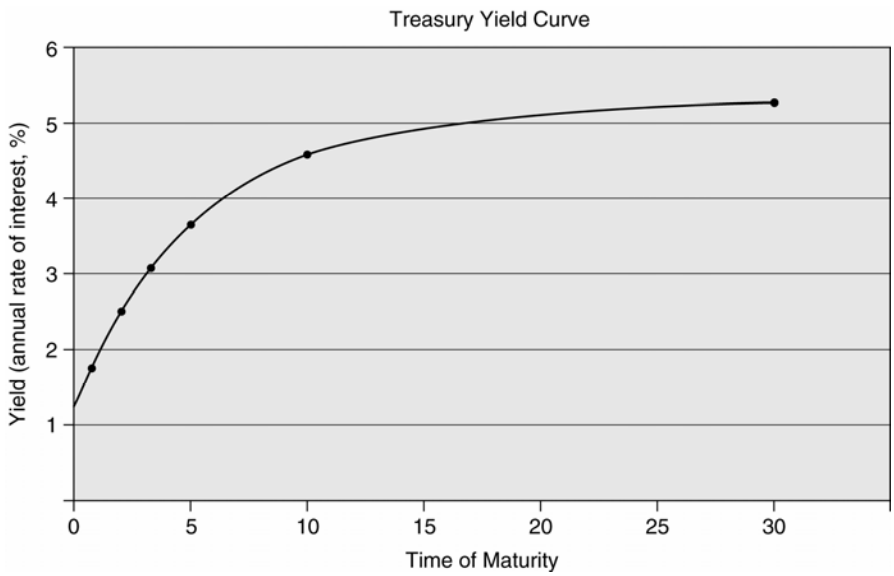
E6-1.



E6-2. Calculating the Present Value of a Bond After an Interest Rate Change.

Answer: The present value of a bond is the present value of its future cash flows. In the case of the 5-year bond, the expected cash flows are $1,200 at the end of each year for 5 years, plus the face value of the bond which will be received at the maturity of the bond (end of year 5). You may use the formula in equation 6.8 on page 306 of your text or you may use a financial calculator. The solution presented below is derived using a financial calculator. Set the calculator on 1 period/year.

PV of Interest: PMT = –1,200
I = 8%/year
N = 5 periods
Solve for PV = $4,791.25

PV of the Bond's Face Value: FV = $20,000
N = 5 periods
I = 8%/year
Solve for PV = $13,611.66

The present value of this bond is $4,791.25 + $13,611.66 = $18,402.91.

This answer is consistent with the knowledge that when interest rates rise, the values of previously issued bonds fall.

E6-3. Calculating Risk Premium

Answer: We calculate the risk premium of other securities by subtracting the risk-free rate, 4.51%, from each nominal interest rate.

Security	**Nominal Interest Rate**	**Risk Premium**
AAA	5.12%	5.12% – 4.51% = 0.61%
BBB	5.78	5.78% – 4.51% = 1.27%
B	7.82	7.82% – 4.51% = 3.31%

E6-4. The Basic Valuation Model

Answer: Find the present value of the cash flow stream for each asset by discounting the expected cash flows using the respective required return.

Asset 1: PV = \$500 ÷ 0.15 = \$3,333.33

Asset 2: $$PV = \frac{\$1,200}{1.10} + \frac{\$1,500}{(1.10)^2} + \frac{\$850}{(1.10)^3} = \$2,969.20$$

Revised E6-7

E6-5. Bond Valuations Using Required Rates of Return

Answer: (a) Student answers will vary but any required rate of return **above** the coupon rate will cause the bond to sell at a discount, while at a required return of 4.5% the bond will sell at par. Any required rate of return **below** the coupon rate will cause the bond to sell at a premium.

(b) Student answers will vary depending upon their answers to part (a).

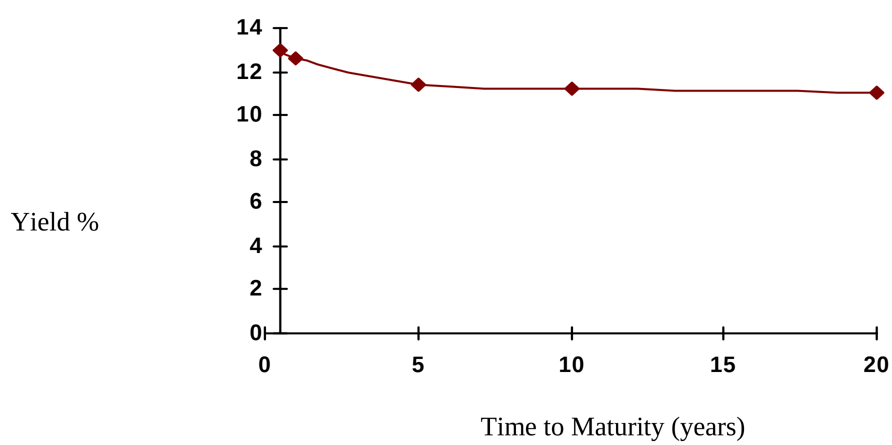
■ Solutions to Problems

P6-1. LG 1: Yield Curve

Intermediate

(a)

Yield Curve of U.S. Treasury Securities



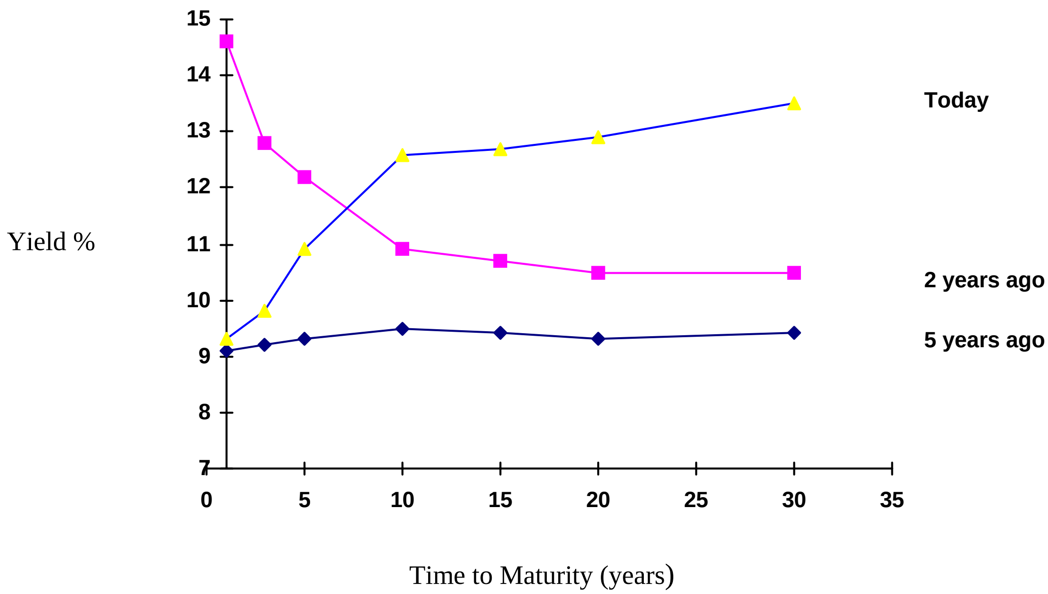
(b) The yield curve is slightly downward sloping, reflecting lower expected future rates of interest. The curve may reflect a general expectation for an economic recovery due to inflation coming under control and a stimulating impact on the economy from the lower rates.

P6-2. LG 1: Term Structure of Interest Rates

Intermediate

(a)

Yield Curve of High-Quality Corporate Bonds



(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: $R_F = k^* + IP$

Security	$\mathbf{K^*}$	**+**	**IP**	**=**	$\mathbf{R_F}$
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: $k = k^* + IP + RP$

Security	$\mathbf{k^*}$	**+**	**IP**	**+**	**RP**	**=**	**k**
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) $R_{Ft} = k^* + IP_t$

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

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

(b) Risk premium:

RP = default risk + interest rate 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) $k_i = k^* + IP + RP$ or $k_1 = R_F$ + Risk premium

Security A: k_1 = 11% + 3% = 14%

Security B: k_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 = ($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 Quotation
Basic

(a) Tuesday, November 7

(b) 0.97708 × $1,000 = $977.08

(c) May 15, 2013

(d) $47,807,000

(e) 5.7%

(f) last yield = 6.06%. This yield represents the expected compounded rate of return the investor would earn if the bond is purchased at the price quoted and the bond is held until the maturity date.

(g) The spread of this FM bond over a similar time to maturity U.S. Treasury bond is 129 basic points, or 1.29%.

P6-7. LG 4: Valuation Fundamentals
Basic

(a) Cash Flows: CF_{1-5} $1,200
CF_5 $5,000
Required return: 6%

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

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

$$V_0 = \$8,791$$

Using PVIF formula:

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

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

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

$V_0 = \$8,789.40$

Calculator solution: $8,791.13

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 $PVIFA_{k\%,n}$	Present Value 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:	$9,713.52
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: 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
Present Value 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) $B_o = I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n})$

$B_o = 120 \times (PVIFA_{10\%,16}) + M \times (PVIF_{10\%,16})$

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

$B_o = \$938.88 + \$218$

$B_o = \$1{,}156.88$

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) $B_o = I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n})$

$B_o = 120 \times (PVIFA_{12\%,16}) + M \times (PVIF_{12\%,16})$

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

$B_o = \$836.88 + \$163$

$B_o = \$999.88$

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

$B_o = I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n})$

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

P6-12. LG 5: Bond Value and Changing Required Returns

Intermediate

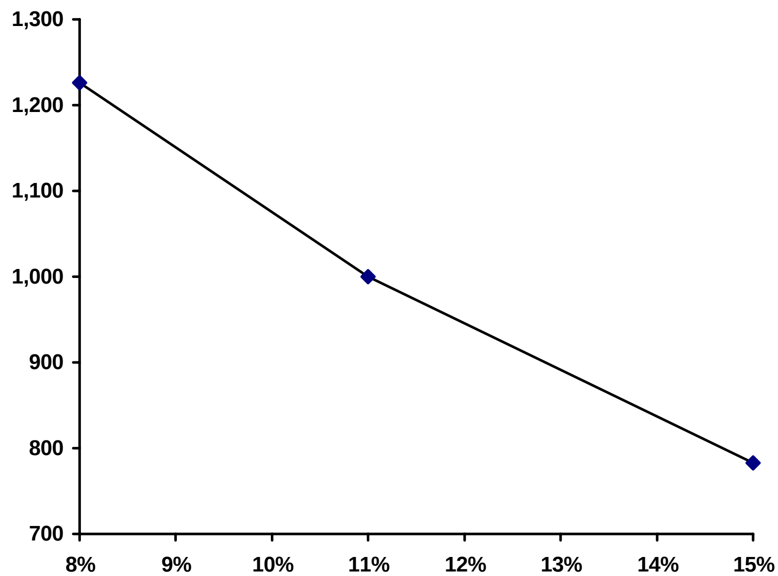
$B_o = I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n})$

(a)

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

(b)

Bond Value versus Required Return



Bond Value ($)

Required Return (%)

(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

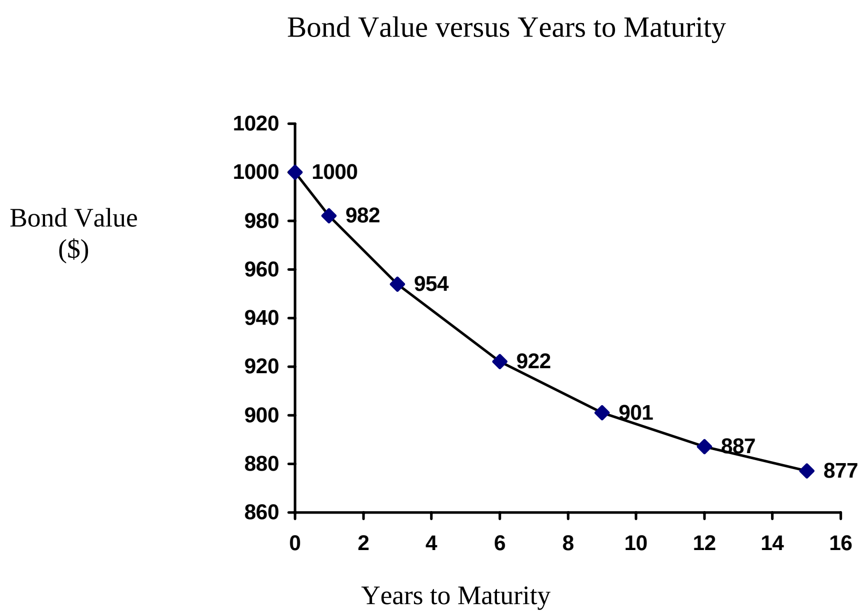
Intermediate

$B_o = I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n})$

(a)

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

(b)



(c) The bond value approaches the par value.

P6-14. LG 5: Bond Value and Time–Changing Required Returns

Challenge

$B_o = I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n})$

(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)	$B_0 = \$110 \times (8.560) + \$1{,}000 \times (0.315) = \$1{,}256.60$	$1,256.78
(2)	$B_0 = \$110 \times (7.191) + \$1{,}000 \times (0.209) = \$1{,}000.00$	$1,000.00
(3)	$B_0 = \$110 \times (6.142) + \$1{,}000 \times (0.140) = \$815.62$	$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:

$B_o = 120 \times (PVIFA_{12.685\%,15}) + 1{,}000 \times (PVIF_{12.685\%,15})$

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

$B_o = \$788.28 + 167$

$B_o = \$955.28$

Since B_o 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	$= \frac{\$90 + [(\$1,000 - \$820) \div 8]}{[(\$1,000 + \$820) \div 2]}$			
	= 12.36%	12.71%	–0.35	12.71%
B	= 12.00%	12.00%	0.00	12.00%
C	$= \frac{\$60 + [(\$500 - \$560) \div 12]}{[(\$500 + \$560) \div 2]}$			
	= 10.38%	10.22%	+0.15	10.22%
D	$= \frac{\$150 + [(\$1,000 - \$120) \div 10]}{[(\$1,000 + \$1,120 \div 2]}$			
	= 13.02%	12.81%	+0.21	12.81%
E	$= \frac{\$50 + [(\$1,000 - \$900) \div 3]}{[(\$1,000 + \$900) \div 2]}$			
	= 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.

P6-18. LG 6: Bond Valuation–Semiannual Interest

Intermediate

$B_o = I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n})$

$B_o = \$50 \times (PVIFA_{7\%,12}) + M \times (PVIF_{7\%,12})$

$B_o = \$50 \times (7.943) + \$1,000 \times (0.444)$

$B_o = \$397.15 + \$444$

$B_o = \$841.15$

Calculator solution: \$841.15

P6-19. LG 6: Bond Valuation–Semiannual Interest

Intermediate

$B_o = I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n})$

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

P6-20. LG 6: Bond Valuation–Quarterly Interest

Challenge

$B_o = I \times (PVIFA_{kd\%,n}) + M \times (PVIF_{kd\%,n})$

$B_o = \$125 \times (PVIFA_{3\%,40}) + \$5,000 \times (PVIF_{3\%,40})$

$B_o = \$125 \times (23.115) + \$5,000 \times (0.307)$

$B_o = \$2,889.38 + \$1,535$

$B_o = \$4,424.38$

Calculator solution: $4,422.13