BONDS (DEBT)—CHARACTERISTICS AND VALUATION (CHAPTER 6)

- Debt Characteristics—debt is a loan
  - Principal Value, Face Value, Maturity Value, and Par Value—all of these terms refer to the amount that is borrowed, thus the amount that has to be repaid, generally at maturity.
  - Interest Payments—the interest/return paid on a bond is based on market rates.
    - The interest paid on corporate bonds is determined by the bond's coupon rate of interest, C; the dollar interest that is paid equals C x (Principal amount).
    - Some debt does not specifically pay interest; rather the debt is sold at a discount—that is, at a price that is below its principal value—and the investor receives the principal value when the debt matures.
  - Maturity Date—the date the debt matures; the date by which all the principal has to be repaid.
  - Priority to Assets and Earnings—when earnings or liquidation proceeds are distributed, debt holders have priority over equity holders.
  - Control of the Firm—debt holders do not have voting rights.

- Types of Debt—many types of debt exist; debt is classified based on time to maturity when issued, the purpose of the debt, issuers of debt, investors who purchase debt, and so forth.
  - Short-Term Debt—debt that matures in one year or less when originally issued. Examples of such debt include: Treasury bills, repurchase agreements, commercial paper, and money market mutual funds.
  - Long-Term Debt—debt that with maturities greater than one year when issued.
    - Term loans—generally a bank loan that requires the firm to make a series of payments that consist of interest and principal (amortized loan)
    - Bonds—a bond is long-term debt; generally interest is paid throughout the period the bond is outstanding and the entire principal (amount borrowed) is paid back at maturity. Interest payments are based on the bond's coupon interest rate, which is the rate that is applied to the principal amount to determine the dollar interest that is paid. For example, if the coupon rate is 10 percent on a $1,000 face value bond, then $100 interest is paid each year. Interest often is paid semiannually, which means $50 would be paid every six months in this case.
      - Government bonds—bonds issued by federal, state, and local governments. Bonds issued by state and local governments are called municipal bonds, or munis for short.
      - Corporate bonds—bonds issued by corporations
      - Mortgage bonds—bonds that have real (tangible) assets pledged as collateral
      - Debenture—an unsecured bond; subordinated debentures represent debt that ranks below other debt with respect to claims on the firm's assets
      - Income bonds—pay interest only when the firm generates sufficient income
      - Putable bonds—can be turned in and exchanged for cash by investors if the firm takes a particular action
      - Indexed, or purchasing power, bonds—interest payments are pegged to some inflation index, perhaps the CPI
      - Floating-rate bonds—interest is pegged to some market index, perhaps the rate on T-bills

        - ♦ Zero coupon bonds—the coupon rate of interest is zero, so no interest is paid; the market prices of these bonds are discounted below the bond's maturity value
        - ♦ Junk bonds—high-risk, high-yield bonds

- Bond Contract Features
    - o Bond Indenture—the bond contract that specifies the maturity date, principal amount, coupon interest, and other features of the bond
    - o Call Provision—a feature that allows the issuer of a bond (borrower) to call it in for repayment prior to maturity; not all bonds have call provisions.
    - o Sinking Fund—a provision to repay the principal amount over a period of time
    - o Convertible feature—a convertible bond can be converted into the firm's common stock at the option of the investors

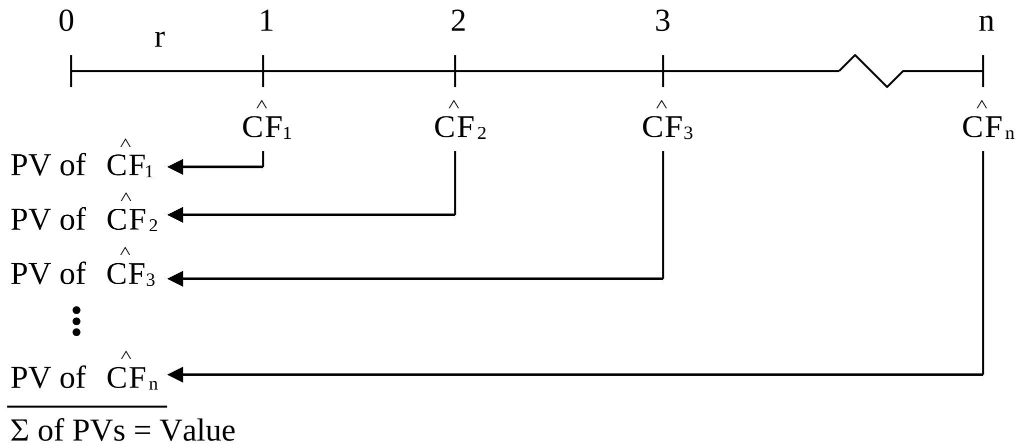
- Bond Ratings—bond ratings provide an indication of the default risk associated with a particular bond. Because bonds with poorer ratings are considered riskier, the yields on such bonds are higher than bonds with better ratings. Some organizations (institutional investors) cannot invest in bonds with low/poor ratings.

- New issues—the coupon rates on bonds will be similar to market interest rates that exist in the market when the bonds are issued; *seasoned issues*, which are bonds that have been traded in the financial markets for a while, can have coupon rates that differ substantially from current market rates because the market rates were significantly different at the time the bonds were issued—for example, some bonds traded in the financial markets perhaps were originally issued 10 to 20 years ago when interest rates were different than today.

- Foreign Debt Instruments
    - o Foreign debt—debt sold by foreign issuers
    - o Eurodebt—debt sold in a country other than the one in the currency in which it is denominated

- Valuation—the general concept of valuation is very simple—the current value of any asset is the present value of the future cash flows it is expected to generate. It makes sense that you are willing to pay (invest) some amount today to receive future benefits (cash flows). As a result, the market price of an asset is the amount you must pay today to receive the cash flows the asset is expected to generate in the future. You should not be willing to pay the asset's market price if you can create the same future cash flow stream yourself by investing a lower amount in other investments—for example, a savings account.

    - o Basic Valuation—if the expected future cash flows and the opportunity cost of an investment can be determined, then the value of the investment can be computed—the value is simply the present value of the future cash flows generated by the investment, which can be depicted on a cash flow timeline as follows:



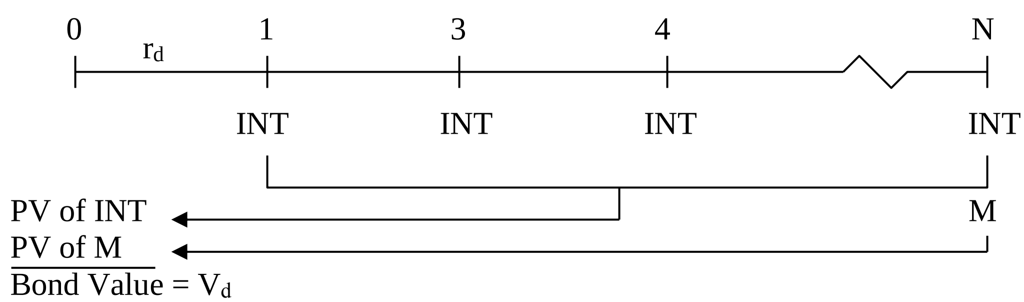
According to the cash flow timeline, the equation to compute the value of an asset is:

$$\text{Asset value} = \frac{\hat{CF}_1}{(1+r)^1} + \frac{\hat{CF}_2}{(1+r)^2} + \cdots + \frac{\hat{CF}_n}{(1+r)^n} = \sum_{t=1}^{n} \frac{\hat{CF}_t}{(1+r)^t}$$

where $\hat{CF}_t$ represents the cash flow expected to be generated by the investment in Period t and r is the rate of return investors require to hold this type of investment.

- <u>Valuation of Bonds</u>—the coupon rate (C) specifies the amount of interest that is paid each year, and the market value of a bond changes as market interest rates change.

  - The basic bond valuation model—the future cash flows associated with a bond include interest payments and the repayment of the amount borrowed. The cash flows associated with a bond are depicted as follows:



where r_d is the rate investors require on bonds with similar risk, N is the number of periods until maturity, INT is the *dollar* interest paid each period, and M is the maturity, or face, value of the bond.

Based on the cash flow timeline given here, the computation for the value of a bond is:

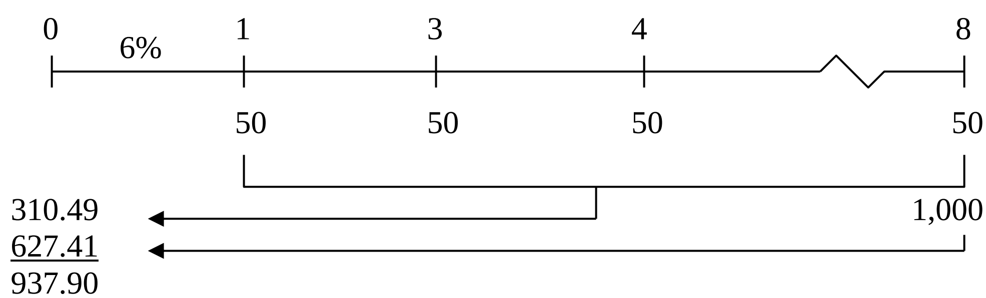
$$\begin{matrix}\text{Bond}\\ \text{Value}\end{matrix} = V_d = \frac{INT}{(1+r_d)^1} + \frac{INT}{(1+r_d)^2} + \frac{INT}{(1+r_d)^3} + \cdots + \frac{INT}{(1+r_d)^N} + \frac{M}{(1+r_d)^N}$$

$$= \sum_{t=1}^{N} \frac{INT}{(1+r_d)^t} + \frac{M}{(1+r_d)^N} = INT\left[\frac{1-\frac{1}{(1+r_d)^N}}{r_d}\right] + M\left[\frac{1}{(1+r_d)^N}\right]$$

Suppose a friend of yours is interested in investing in a corporate bond that has a face value of $1,000, a coupon rate equal to 5 percent, and eight years remaining until maturity. Generally, we would refer to this bond as an 8-year, 5 percent bond, and, unless stated otherwise, we assume the face value is $1,000. Help your friend out by computing the price that should be paid for this bond if the market return on bonds with similar risk is equal to 6 percent. Assume interest is paid annually.

Using the approaches described in the time value of money (TVM) notes, the solution is as follows:

- ***Timeline Solution:***



- ***Equation (Numerical) Solution****:* Using the relationships given earlier, we have the following situation:

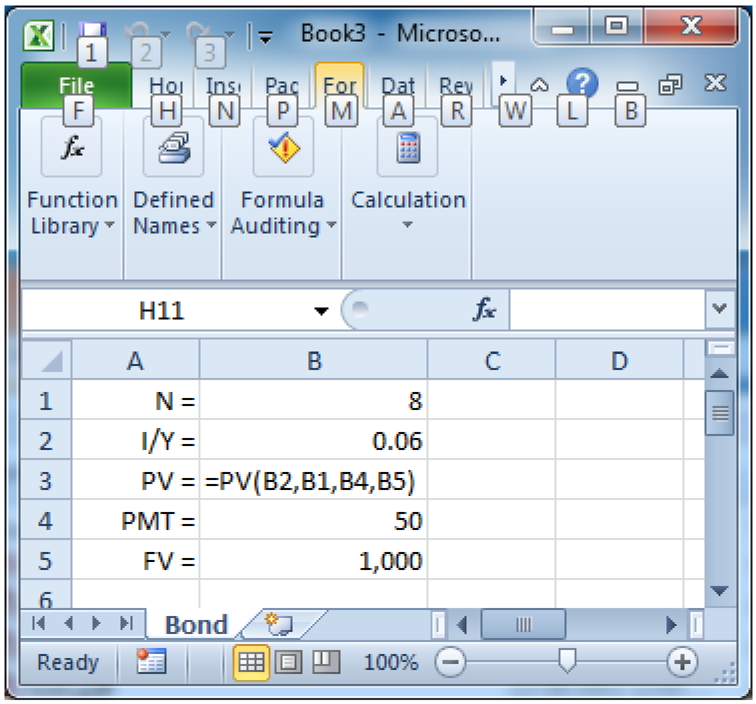
$$V_d = INT\left[\frac{1-\frac{1}{(1+r_d)^N}}{r_d}\right] + M\left[\frac{1}{(1+r_d)^N}\right]$$

$$= \$50\left[\frac{1-\frac{1}{(1.06)^8}}{0.06}\right] + \$1{,}000\left[\frac{1}{(1.06)^8}\right] = \$50(6.20979) + \$1{,}000(0.62741) = \$937.90$$

♦ ***Financial Calculator Solution***:

Inputs:	8	6	?	50	1000
	N	**I/Y**	**PV**	**PMT**	**FV**
Result:			**= -937.90**		

♦ ***Spreadsheet Solution:*** Using Excel, the current problem can be solved using the PV function described in the time value of money section of the notes, the bond's characteristics can be set up as follows:



Notice that, in this case, you can use the same PV function described in the time value of money (TVM) section of the notes, but now both the PMT and FV cells have values entered.

- <u>Finding Bond Yields (Market Rates): Yield to Maturity and Yield to Call</u>
  - Yield to Maturity (YTM)—the return earned on a bond that is purchased and held until maturity is termed the bond's *yield to maturity, YTM*. The YTM associated with a bond basically represents the average rate of return that is earned on the bond from now until it matures. Consider the fact that we can find the market value of a bond by looking in a financial publication such as *The Wall Street Journal*, which also gives information about the bond's maturity and its coupon interest rate. For example, suppose IBM has a 5-year, 10 percent bond outstanding that currently is selling for $1,123. First, let's interpret this information—the bond has five years until it matures, the coupon rate of interest is 10 percent, and its market price is $1,123. The dollar interest paid each year is $100 = 0.10 ×

$1,000 (at this point we will assume the bond pays interest annually, although interest probably is paid semiannually).

♦ ***Equation (Numerical) Solution:*** Plugging this information into the equation we use to compute the value of a bond, we have:

$$\$1{,}123 = \frac{\$100}{(1+r_d)^1} + \frac{\$100}{(1+r_d)^2} + \frac{\$100}{(1+r_d)^3} + \frac{\$100}{(1+r_d)^4} + \frac{\$100}{(1+r_d)^5} + \frac{\$1{,}000}{(1+r_d)^5}$$

$$= 100\left[\frac{1-\frac{1}{(1+r_d)^5}}{r_d}\right] + 1{,}000\left[\frac{1}{(1+r_d)^5}\right]$$

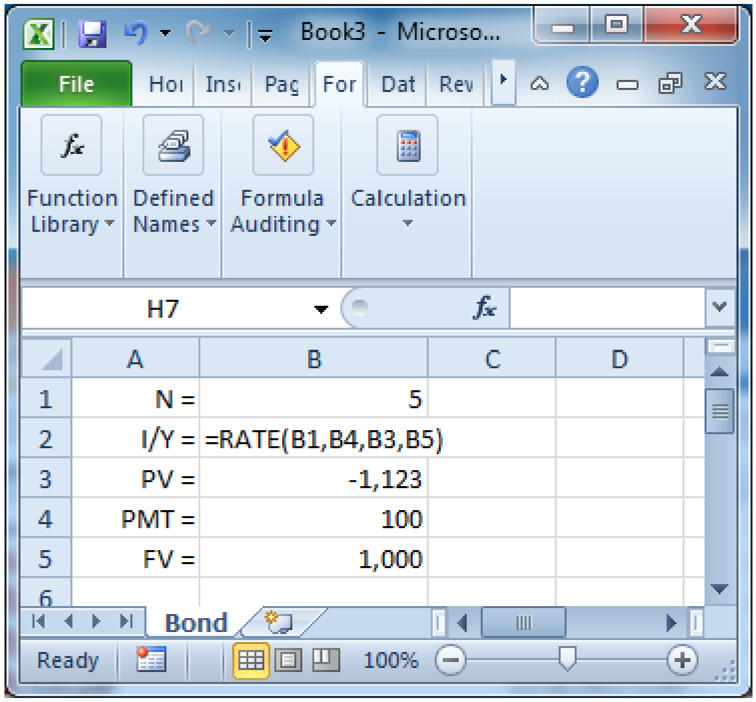
Solving for r_d gives us the YTM for this bond—that is, r_d = YTM. Using the equation, you would have to use a trail-and-error approach to solve for r_d.

♦ ***Financial Calculator Solution:*** The easiest way to compute r_d is to use the TVM keys on your calculator, which gives the following solution:

Inputs:	5	?	-1,123	100	1,000
	N	**I**	**PV**	**PMT**	**FV**
Result:		**7.0**			

Therefore, the yield to maturity for this bond is 7.0 percent. Notice that the YTM, 7.0 percent, is much lower that the coupon rate of interest, 10 percent. This is because the bond's market price is $1,123, which is $123 greater than the bond's face value, $1,000. The relationship between the coupon rate of interest and the market rate of interest, or yield to maturity, and the price of a bond will be discussed later.

♦ ***Spreadsheet Solution:*** If you use a spreadsheet to solve for the YTM, you can use the RATE function discussed in the time value of money (TVM) section of the notes. The inputs are: Nper = 5, Pmt = 100, Pv = –1,123, and Fv = 1,000. You can set up the spreadsheet as follows:



Let's consider another bond: Arctic Heating has a 6-year, 11½ percent bond that currently is selling for 80¼, which means the market price of the bond is 80.25 percent of its face value, or $802.50 = $1,000 x 0.8050.

- ***Financial Calculator Solution:*** Assuming interest is paid annually, we have the following solution for the YTM of this bond:

Inputs:	6	?	-802.50	115	1,000
	N	**I**	**PV**	**PMT**	**FV**
Result:		**17.00**			

In this case, because the bond is selling for a fairly substantial discount ($97.50 = $1,000 - $802.50), its YTM, 17.00 percent, is much greater than the coupon rate of interest, 11.50 percent.

The YTM on the Arctic Heating bond, 17.00 percent, is much greater than the YTM on the IBM bond, 6.84 percent. Why? The primary reason is risk—Arctic Heating has much greater default risk than IBM.

If you do not have a financial calculator, you can *approximate* a bond's yield to maturity using the following equation:

$$\begin{array}{c}\text{Approximate yield}\\ \text{to maturity}\end{array} = \frac{\text{INT} + \left(\frac{\text{M}-\text{V}_d}{\text{N}}\right)}{\left[\frac{2(\text{V}_d)+\text{M}}{3}\right]}$$

Solving for the approximate YTM for the original IBM bond and the Arctic Heating (AH) bond, we have:

$$\begin{array}{c}\text{Approximate}\\ \text{YTM}_{\text{IBM}}\end{array} = \frac{\$100 + \left(\frac{\$1{,}000-\$1{,}123}{5}\right)}{\left[\frac{2(\$1{,}123)+\$1{,}000}{3}\right]} = \frac{\$75.40}{\$1{,}082} = 0.0697 = 6.97\% \approx 7.0\%$$

$$\begin{array}{c}\text{Approximate}\\ \text{YTM}_{\text{AH}}\end{array} = \frac{\$115.00 + \left(\frac{\$1{,}000-\$802.50}{6}\right)}{\left[\frac{2(\$802.50)+\$1{,}000}{3}\right]} = \frac{\$147.92}{\$868.33} = 0.1703 = 17.03\%$$

As you can see, the approximate YTMs are fairly close to the actual YTMs.

- Yield to Call (YTC)—the yield to call is the same as the yield to maturity, except the return is computed using the call price and the call date of the bond rather than the maturity value and the maturity date of the bond (assuming the bond has a call provision). For example, suppose a firm has a 10-year, 9 percent bond outstanding that currently is selling for $1,040. The bond is callable in five years for $1,090 (call price). Interest is paid annually.

  - ***Equation (Numerical) Solution:*** Plugging this information into the equation we use to compute the value of a bond, the YTM is:

$$\text{V}_d = \frac{\text{INT}}{(1+\text{YTM})^1} + \frac{\text{INT}}{(1+\text{YTM})^2} + \cdots + \frac{\text{INT} + \text{Maturity value}}{(1+\text{YTM})^\text{N}}$$

$$\$1{,}040 = \frac{\$90}{(1+\text{YTM})^1} + \frac{\$90}{(1+\text{YTM})^2} + \cdots + \frac{\$90}{(1+\text{YTM})^{10}} + \frac{\$1{,}000}{(1+\text{YTM})^{10}}$$

The YTC is computed as follows:

$$\text{V}_d = \frac{\text{INT}}{(1+\text{YTC})^1} + \frac{\text{INT}}{(1+\text{YTC})^2} + \cdots + \frac{\text{INT}}{(1+\text{YTC})^{\text{N}_c}} + \frac{\text{Call value}}{(1+\text{YTC})^{\text{N}_c}}$$

$$\$1{,}040 = \frac{\$90}{(1+\text{YTC})^1} + \frac{\$90}{(1+\text{YTC})^2} + \frac{\$90}{(1+\text{YTC})^3} + \frac{\$90}{(1+\text{YTC})^4} + \frac{\$90 + \$1{,}090}{(1+\text{YTC})^5}$$

♦ ***Financial Calculator Solution:***

YTM

Inputs:	10	?	-1,040	90	1,000
	N	**I**	**PV**	**PMT**	**FV**
Result:		**8.39**			

Therefore, the yield to maturity (YTM) for this bond is 8.39 percent.

YTC

Inputs:	5	?	-1,040	90	1,090
	N	**I**	**PV**	**PMT**	**FV**
Result:		**9.45**			

The yield to call (YTC) for this bond is 9.45 percent.

If the bond is called in five years, the company will pay a call price equal to $1,090 to retire the debt. In this case, investors who buy the bond today and hold it until the call date will earn an average return equal to 9.45 percent. If the bond is not called and investors hold it until maturity, their average return will be 8.39 percent.

- Interest Rates and Bond Values—the market values of bonds are inversely related to market interest rates—that is, when interest rates increase, the values of bonds decrease. This relationship exists because investors who buy bonds (or other investments) expect to earn the market rate of return. As a result, if market rates increase, investors will want to pay lower prices to purchase bonds so that they can earn the higher returns. Remember that the coupon interest and maturity value of a bond do not change, even when market conditions do change, because they are fixed contractually (in the indenture). So, because the payments made by the bond issuer to bondholders do not change, a change in the market price of a bond effectively adjusts the bond's market return.

  To illustrate the relationship between the market value of a bond and its market return (YTM), suppose that there exists a 10-year, 6 percent bond with a $1,000 face value. The following table shows the relationships between market rates and coupon rates (= INT/M) on this bond at three different market rates (YTMs):

				Current example: N = 10 yrs, INT = $60, M = 1,000	
Relationship of Interest Rates			Selling Price	r_d = YTM	Value = V_d =
Market rate	=	Coupon rate	par	6%	$1,000.00
Market rate	>	Coupon rate	discount	10%	$ 754.22
Market rate	<	Coupon rate	premium	4%	$1,162.22

Following is the financial calculator solution for the value of the bond when the market rate (YTM) is 10 percent. To compute the market value of the bond when the market rate is 4 percent, simply change I/Y to 4.

Inputs:	10	10	?	60	1000
	N	**I/Y**	**PV**	**PMT**	**FV**
Result:			**= -754.22**		

This table indicates that when the market rate is 6 percent, the bond will sell at par—that is, $1,000. This makes sense, because bondholders will receive $60 per year for a $1,000 investment, which represents a 6 percent yield (i.e., 0.06 = $60/$1,000). On the other hand, when the market rate is 10 percent, the bond will sell for $754.22, which is lower than its face value—that is, the bond sells at a discount. If investors buy the bond for $754.22, they will receive $60 per year and $1,000 at maturity, which equates to an average annual return that is approximately 10 percent.

Suppose you bought the bond for $1,000 when it was originally issued, and you now want to sell it when the market rate (YTM) is 10 percent. Because you paid $1,000, you want to sell the bond for $1,000 so that you don't lose any of your original investment. Would investors be willing to pay $1,000 for the bond today if the market rate on similar-risk, newly issued bonds is 10 percent? The answer is a resounding NO! Any investor who buys your bond for $1,000 will be paid $60 interest per year, which will generate a 6 percent return. Why would any investor pay you $1,000 for your bond to earn a 6 percent return when he or she could buy a similar bond from someone else and earn a 10 percent return? Rational investors would not want to pay $1,000 for your bond, so you must lower its price to an amount that equates the YTM that is earned by the investor who buys your bond to the 10 percent opportunity cost that currently exists in the financial markets. To understand why you must decrease the price of your bond, think about the situation an investor who wants to purchase a similar-risk bond faces. The investor can either purchase your bond, which pays interest equal to $60 per year, or purchase a newly issued bond that has a coupon rate of interest equal to 10 percent, and thus pays interest equal to $100 per year. Because you cannot change the amount of annual interest paid on your bond and your bond pays $40 less interest per year than a newly issued bond (i.e., $40 = $100 – $60), you must adjust the price of your bond to make up for the fact that whoever buys your bond receives less interest than investors who purchase newly issued bonds. Basically, you must decrease (discount) the price of your bond to "pay" the buyer (investor) the interest he or she will lose by purchasing your bond rather than purchasing a newly issued bond. In other words, you must make up the difference between the annual interest paid on newly issued bonds and the annual interest paid on your bond. Because your bond pays $40 per year less than newly issued bonds for the *next* 10 years, we can determine by how much you must discount the price of the price of your bond by computing the present value of a 10-year $40 ordinary annuity at the current market rate of 10 percent. Following is the financial calculator solution:

Inputs:	10	10	?	40	0
	N	**I/Y**	**PV**	**PMT**	**FV**
Result:			**= -245.78**		

Thus, you should discount your bond by $245.78, which means you can sell it for $754.22 = $1,000 – $245.78. This is the same result we found earlier when we computed the present value of the bond's cash flows using a financial calculator; that is, $754.22.

Notice that when the market rate is below the bond's coupon rate—for example, 4 percent—you can sell your bond for a premium—$1,162.22 in this case. If you offered your bond for $1,000, every investor would want to purchase it, because the bond's yield would be 6 percent at the same time the market rate is 4 percent. In this case, the relationship between the market rate and the bond's coupon rate of interest is $r < C$, which is opposite the previous situation where $r > C$. As a result, the value of your bond is greater than its face value because your bond pays more annual interest than similar-risk, newly issued bonds. Therefore, when selling your bond, you can effectively require the purchaser to pay you for the additional annual interest he or she will receive from your bond compared to a newly issued bond. Following the same logic we applied earlier, we can determine the amount by which the value of your bond increases by computing the present value of the difference between the interest paid on your bond and the interest paid on newly issued bonds; that is, compute the present value of a 10-year $20 annuity at the current market rate of 4 percent (interest on your bond is $60; interest on a newly issued bond is $40).

Inputs:	10	4	?	20	0
	N	**I/Y**	**PV**	**PMT**	**FV**
Result:			**= -162.22**		

Thus, you can actually sell your bond for $1,162.22. If you sell the bond for $1,162.22, the investor who buys it will expect to earn a YTM equal to 4 percent, which is the current market return.

- <u>Change in Bond Values Over Time</u>—No matter the current value of a bond, it must sell for its face value at the maturity date (assuming the issuer does not default) because this amount is repaid at maturity. Therefore, all else equal, the value of the bond that is selling for a discount (premium) must increase (decrease) as the term to maturity decreases—that is, as the bond gets closer to maturity—because its value at maturity must equal $1,000. To show that this is the case, let's compute the price of a bond, which has the following characteristics, each year as it approaches its maturity.

Face value	$1,000	
Years to maturity	5	
Coupon rate of interest, C	6%	
Annual interest payment	$60	= $1,000 x 0.06
YTM = r_d	8%	

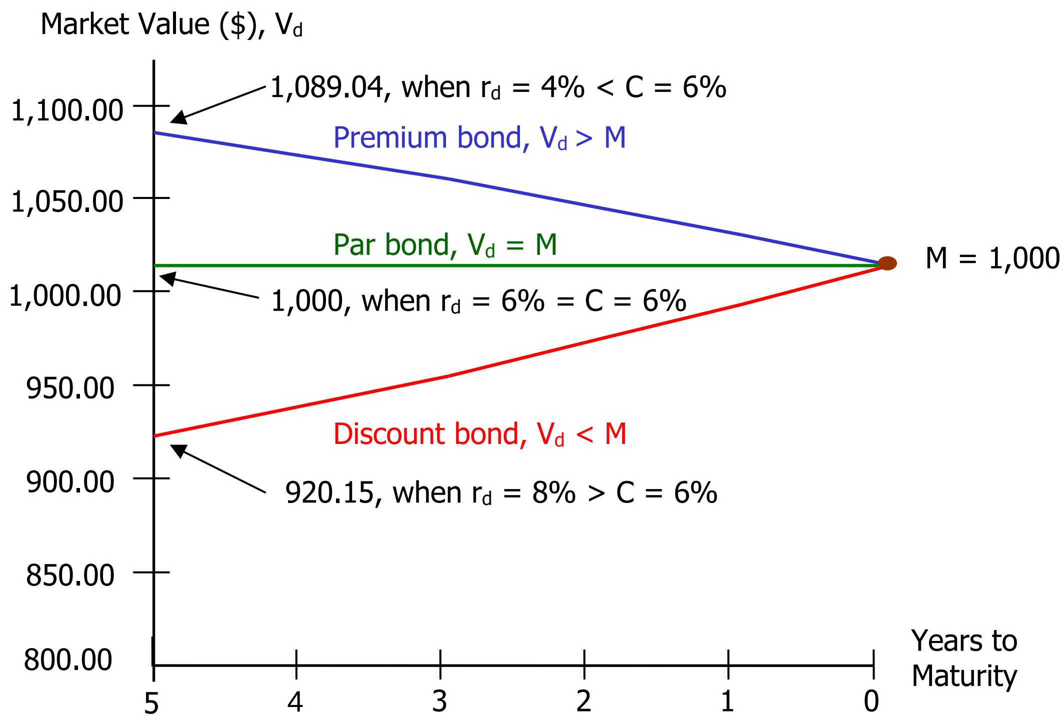
Using your calculator, simply enter N = 5, I/Y = 8, PMT = 60, and FV =1,000, and then solve for PV. The following table shows what happens to the value of the bond as the maturity date nears. To check these figures, just decrease the value you enter for N by one for each year that passes and then recompute the PV.

Years to Maturity	End of year Bond Value	Percent Change in Value—Capital Gain	+	Current Yield	=	Total Return
5	$ 920.15					
4	933.76	1.48%		6.52%		8.00%
3	948.46	1.57		6.43		8.00
2	964.33	1.67		6.33		8.00
1	981.48	1.78		6.22		8.00
0	1,000.00	1.89		6.11		8.00

In the table, the *capital gains yield* represents the change—increase in this example—in the value of the bond from one year to the next, which is computed as $[(V_{d1} – V_{d0})/V_{d0}] –1.0$. For example, 1.48% = ($933.76 – $920.15)/$920.15. The *current yield* is computed by dividing the dollar interest received during the year by the value of the bond at the *beginning* of the year—for example, 6.52% = $60/$920.15, 6.43% = $60/$933.76, and so forth.

Notice that, in each year, the total return is 8 percent. Remember that we valued the bond using r_d = 8%, which indicates that investors demand an 8 percent return to purchase this bond. Therefore, everything else equal, each year, investors will expect an 8 percent return. What do you think would happen if the bond paid a lower return, say, 7 percent, even though investors demanded an 8 percent return? Investors would no longer find the bond attractive, thus they would quit investing in it, which would cause the price to drop and the return to increase until it reached 8 percent. Think about what would happen if the bond paid a return greater than 8 percent. Answer this question by asking yourself whether you would want to own such a bond. In reality, every investor would want this bond. As a result, buying pressure would increase the bond's price, and thus decrease its yield to maturity (YTM).

The following graph shows the values of the bond in our illustration as it approaches its maturity date for three different scenarios: (1) the bond is currently selling at a premium—that is, V_d = $1,089.04—when r_d = 4%, (2) the bond is selling at its par value—that is, V_d = $1,000—when r_d = 6%, and (3) the bond is selling for a discount—that is, V_d = $920.15—when r_d = 8%.



- Bond Values with Semiannual Compounding—most bonds pay interest on a semiannual basis rather than annually, which we have assumed to this point. For such bonds, we need to adjust the discount rate, r_d, and the number of periods just like we did for time value of money problems with multiple compounding in the year. For example, let's assume the bond we previously evaluated that has a $1,000 face value, five years remaining until maturity, and a coupon interest rate equal to 6 percent pays interest semiannually. If investors demand an 8 percent return (annual) to invest in similar risk bonds, then the price of this bond should be:

$$V_d = \$30\left[\frac{1-\frac{1}{(1.04)^{10}}}{0.04}\right] + \$1{,}000\left[\frac{1}{(1.04)^{10}}\right]$$

$$= \$30(8.110896) + \$1{,}000(0.675564) = \$918.89$$

According to this computation, the bond pays $30 every six months (semiannually), the investor has the opportunity to invest at 4 percent interest every six months, and there are 10 six-month periods during the remaining life of the bond. Thus, if you invest in this bond, you would receive a $30 annuity paid twice per year for the next five years.

- Interest Rate Risk on a Bond—interest rates change constantly in the financial markets, thus investors face *interest rate risk* continuously with their investments. Interest rate changes affect investors who hold bonds in two ways—when interest rates change, (1) the market value of the bond changes and (2) so does the rate at which the interest received by investors can be reinvested.

The following table shows what would happen to the value of the bond we examined earlier ($60 interest payment annually and five years until maturity) if interest rates *immediately* after the bond was purchased are as follows:

Market Rate, r_d	Bond Value, V_d	
4%	$1,089.04	
6	1,000.00	
8	**920.15**	– current market value
10	848.37	
12	783.71	

Notice that the value of the bond is inversely related to the market rate—if the rate increases, the value decreases. The reason for this is because investors receive a fixed amount of future cash flows (interest) when they buy bonds like the one we are examining here. If the market rates change, the bond's value changes such that if an investor purchases the bond after the rate change, he or she will earn a YTM equal to the market rate of return. Consider what would happen if you purchased the bond when the market rate was 8 percent, thus you paid $920.15. As soon as the purchase was completed the market rate jumped to 10 percent, so you decide to sell the bond so that you can invest in a different bond that earns 10 percent rather than 8 percent. Because you paid $920.15 for the bond and only held it for a short time, you might think you can sell it for the same price. Who do you think would be willing to buy the bond? The answer is *NOBODY*, because investors can now earn 10 percent on similar risk bonds and if they purchased your bond for $920.15 they would only earn 8 percent. As a result, you must adjust the price of your bond so that it now generates a 10 percent return—that is, you must drop its price to $848.37. The *price* of the bond changes each time market interest rates change; this risk is called *interest rate* ***price*** *risk.*

Given the preceding discussion, you might think that when interest rates increase, bondholders are unhappy because the prices of their bonds decrease. But, although the price of the bond in our example would drop to $848.37 if interest rates increased from 8 percent to 10 percent, you would now be able to invest the interest payment received from the bond every year at 10 percent compounded annually rather than 8 percent. This is an example of *interest rate* ***reinvestment*** *risk*, which has the opposite effect of interest rate price risk when market rates change. That is, if market interest rates increase (decrease) the prices of bonds decrease (increase), but investors are able to reinvest any income received from the bonds at the higher (lower) rates.

- Bonds Summary Questions—You should answer these questions as a summary for the chapter and to help you study for the exam.
  - In simple terms, how is value determined?
  - How is the market value of a bond determined?
  - What are the components of the return on a bond called?
    - What is the yield to maturity (YTM)?
    - What is the relationship between YTM, coupon rate, and market value of a bond?
  - How does the price of a bond change over time? Does the price of a bond change over time even if interest rates do not change? Explain.