## Congratulations! You passed!

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**1.** Suppose that you have purchased a 3-year zero-coupon bond with face value of $1000 and a price of $850. If you hold the bond to maturity, what is your annual return? **1 / 1 point**

**Make sure to input all currency answers without any currency symbols or commas, and use two decimal places of precision.*

0.06

**Correct**

The annual return in this case equals the yield to maturity. The yield to maturity is the rate $r$ that solves:

$$\$850 = \frac{\$1000}{(1+r)^3}$$

Inverting the equation as usual, we find:

$$r = (\frac{\$1000}{\$850})^{1/3} - 1 = 0.056$$

**2.** Now suppose you have purchased a 3-year bond with face value of $1000, a 7% annual coupon, and a price of $975. Is the yield to maturity greater or less than the annual return you computed for the bond in the previous question **1 / 1 point**

- (•) Yield to Maturity is GREATER than the Annual Return
- ( ) Yield to Maturity is LESS than the Annual Return

**Correct**

Recall that the yield to maturity is defined as the interest rate that makes the present value of the payments equal to the price. Hence the yield to maturity (annual compounding) solves:

$$\$975 = \frac{\$70}{(1+r)} + \frac{\$70}{(1+r)^2} + \frac{\$1070}{(1+r)^3}$$

When we put in $r = 5.6\%$, we find:

$$\frac{\$70}{1.056} + \frac{\$70}{1.0562} + \frac{\$1070}{1.0563} = \$1037.70$$

Thus to make the present value equal to the price of $975, the yield to maturity must be greater than 5.6%, the yield to maturity for security A.

**3.** Suppose you bought a five-year zero-coupon Treasury bond for $800 per $1000 face value. What is the yield to maturity (annual compounding) on the bond? **1 / 1 point**

**Make sure to input all percentage answers as numeric values without symbols, and use four decimal places of precision. For example, if the answer is 6%, then enter 0.0600.*

0.0456

**Correct**

With F equal to face value, P equal to purchase price. and t equal to years to maturity, the yield to maturity for a zero-coupon bond is given by:

$$YTM = (\frac{F}{P})^{\frac{1}{t}} - 1$$

$$= (\frac{\$1000}{\$800})^{\frac{1}{5}} - 1 = 0.0456$$

So $YTM = 4.56\%$

**4.** Suppose you bought a five-year zero-coupon Treasury bond for $800 per $1000 face value. Assume the yield to maturity on comparable bonds increases to 7% after you purchase the bond and remains there. Calculate your holding period return (annual return) if you sell the bond after one year. **1 / 1 point**

**Make sure to input all currency answers without any currency symbols or commas, and use two decimal places of precision.*

-0.05

**Correct**

Holding period return is given by

$$HPR = \left(\frac{P_t}{P_0}\right)^{\frac{1}{t}} - 1$$

where $P_0$ is the purchase price of the bond, $P_t$ is the selling price, and t is the number of years the bond is held. This bond must also yield 7% to those you sell it to after one year. Using the formula for the price of a zero and recalling that the 5-year bond becomes a 4-year bond after one year, we have:

$$\mathrm{P_t} = \frac{\$1000}{(1+.07)^4} = \$762.90$$

Therefore, the holding period return when you sell this bond after one year assuming yields have increased from 7% is:

$$\mathrm{HPR} = \frac{\$762.90}{\$800} - 1 = -0.0464$$

Your return is less than the YTM because yields rose and you sold the bond at a lower price. Moreover, you actually lost money.

**5.** Suppose you bought a five-year zero-coupon Treasury bond for $800 per $1000 face value. Assuming yields to maturity on comparable bonds remain at 7%, calculate your holding period return if you sell the bond after two years. **1 / 1 point**

**Make sure to input all currency answers without any currency symbols or commas, and use two decimal places of precision.*

0.01

**Correct**

The selling price after 2 years is:

$$\mathrm{P_t} = \frac{\$1000}{(1+.07)^3} = \$816.30$$

and your holding period return over the two-year period is:

$$\mathrm{HPR} = \left(\frac{\$816.30}{\$800}\right)^{1/2} - 1 = 0.0101$$

Note that even though rates are still 7%, your holding period return over the two years is positive because the selling price of the bond is now higher than after one year.

**6.** Suppose you bought a five-year zero-coupon Treasury bond for $800 per $1000 face value. Suppose after 3 years, the yield to maturity on comparable bonds declines to 3%. Calculate the holding period return if you sell the bond at that time. **1 / 1 point**

**Make sure to input all currency answers without any currency symbols or commas, and use two decimal places of precision.*

0.0562

**Correct**

Since the yield to maturity on comparable zeros is now 3% and there are two years left to maturity, your selling price is:

$$\mathrm{P_t} = \frac{\$1000}{(1+.03)^2} = \$942.60$$

and your holding period return over three years is:

$$\mathrm{HPR} = \left(\frac{\$942.60}{\$800}\right)^{\frac{1}{3}} - 1 = 0.056$$

**7.** Assume the government issues a semi-annual bond that matures in 5 years with a face value of $1,000 a coupon yield of 10 percent. What would be the price if the yield to maturity (semi-annual compounding) on similar government bonds were 8%? **0 / 1 point**

**Make sure to input all currency answers without any currency symbols or commas, and use two decimal places of precision.*

1081.11

**Incorrect**

**8.** For each of the bonds and reinvestment rates listed below calculate the amount of money accumulated at the end from a $1000 initial investment. Assume annual compounding. **0 / 1 point**

Invest $1000 in a 5-year zero coupon bond with a yield to maturity of 9 percent.

**Make sure to input all currency answers without any currency symbols or commas, and use two decimal places of precision.*

2367.36

✗ **Incorrect**

**9.** Bond A is zero-coupon bond paying $100 one year from now. Bond B is a zero-coupon bond paying $100 two years from now. Bond C is a 10% coupon bond that pays $10 one year from now and $10 plus the $100 principal two years from now. The yield to maturity on bond A is 10%, and the price of bond B is $84.18. Assuming annual compounding, what is the price of Bond A? **1 / 1 point**

**Make sure to input all currency answers without any currency symbols or commas, and use two decimal places of precision.*

90.91

✓ **Correct**

The price of the 1-year zero coupon bond satisfies the relation

$$P = \frac{F}{1+r_1}$$

$$= \frac{\$100}{(1+.10)} = \$90.91$$

**10.** Bond A is zero-coupon bond paying $100 one year from now. Bond B is a zero-coupon bond paying $100 two years from now. Bond C is a 10% coupon bond that pays $10 one year from now and $10 plus the $100 principal two years from now. The yield to maturity on bond A is 10%, and the price of bond B is $84.18. Assuming annual compounding, what is the yield to maturity on Bond B? **1 / 1 point**

**Make sure to input all percentage answers as numeric values without symbols, and use four decimal places of precision. For example, if the answer is 6%, then enter 0.0600.*

0.0899

✓ **Correct**

The YTM on a zero-coupon bond satisfies

$$r_2 = \left(\frac{F}{P}\right)^{\frac{1}{t}} - 1$$

$$= \left(\frac{100}{84.18}\right)^{\frac{1}{2}} - 1 = 8.99\%$$