1. Which of the following yields is **not** guaranteed in advance as a risk-free return over the entire lifetime of the bond, even if you hold until its maturity date?

A) The yield to maturity on a 3-month Treasury bill
B) The yield to maturity on a 10-year Treasury note
C) The yield to maturity on a 10-year Treasury STRIP
D) The yield to maturity on a 10-year zero-coupon Treasury bond

2. A 10-year zero-coupon Treasury STRIP is trading at a yield of 5%. How much does $10,000 of principal cost today? (Round to the nearest penny.)

3. A 3-month Treasury bill offers a yield of 5%. How much does $10,000 of principal cost today? (Round to the nearest penny.)

4. Suppose you buy $10,000 principal of a one-year Treasury ~~note~~ bill at a yield of 5%. Six months later, you sell it. At the date you sell, 6-month Treasuries have a yield of 4%. What return did you make on your trade, as a percent? (Round to two decimal places, for example 3.33%)

Note: Whenever I ask you to do calculations with a yield, we will only use zero-coupon bonds. In these situations, the yield I will ask you to calculate is technically called an *effective annual yield*. This is almost the same thing as *yield to maturity*, but the real-world definition of YTM can be confusing in practice and we don't want to get into it. The *effective annual yield* just means figure out the return from holding the zero-coupon bond until its maturity date, then annualizing to a one-year rate of return using an exponent. This is the way we will always do things in class, so I am just providing this note for anyone paying very close attention.

Answers:

1. B. Unlike the others, the 10-year Treasury note pays coupons. The YTM mostly reflects a return from the amount of the coupon that will be paid each year. You cannot guarantee in advance that you will be able to continue earning the same rate of return from each coupon after it is paid – this depends on how interest rates move during the next 10 years. This is called "reinvestment risk." And this is the reason why our risk-free rates will always come from **zero-coupon** bonds. The other answers listed are all zero-coupon bonds. (A Treasury STRIP and a zero-coupon Treasury bond are the same thing. Treasury bills are 1 year to maturity or less and are also zero-coupon.)

2. As noted, we always think of yields on zero-coupon bonds as being "effective annual yields."
The price of \$10,000 principal today is $\$10{,}000/(1.05^{10})$ = **\$6139.13.**

3. We just replace the 10 with a 0.25 (because 3 months is one-quarter of a year).
The price of \$10,000 principal today is $\$10.000/(1.05^{0.25})$ = **\$9878.77.**

4. You buy initially at a price of \$10,000/1.05 = \$9523.81.
You sell at a price of $\$10{,}000/(1.04^{0.5})$ = \$9805.81.
Your return is (9805.81 – 9523.81)/9523.81 = 0.02960999, that is, **2.96%**.

Bonus topic (not testable!): Suppose we knew in advance that the six-month yield would be 4% at the sale date. The "expectations hypothesis" is the idea that today's six-month yield should match the return from buying the one-year today and selling it in six months. If today's six-month Treasury offers a return of 2.96% over the next six months, that implies a yield of $1.0296^2 - 1 = 6\%$. So we would expect to see an **inverted yield** curve today (6% for the six-month Treasury and 5% for the one-year Treasury). This shape tells us that the market expects six-month yields to fall over the next six months.