

M110

SECTION 11.2

COMPOUND INTEREST

Example: Suppose you invest \$2,000 in a bank that pays 10% annual interest. How much will you have in your account after 3 years?

COMPOUND INTEREST is where your money earns interest, but then the interest is reinvested and come the next payment period your money and interest earned in the previous period earns interest.

Example: Suppose you invest \$2,000 in a bank that pays 10% compounded annually. How much will you have in your account after 3 years?

At the end of the:

1st year

Interest _____

Amount _____

2nd year

Interest _____

Amount _____

3rd year

Interest _____

Amount _____

Notice that the interest earned each year keeps increasing. This is the effect of compound interest!

Each investment (or loan) has a defined number of payment periods:

annually - once per year

semiannually _____ per year

quarterly _____ per year

monthly _____ per year

daily strangely, 360 times per year

In general, if the number of compounding periods increases, the result is an increase in the interest earned by the account.

Obviously we would not want to “walk” ourselves through this every time – particularly if the number of compounding periods increases (semiannually for 5 years, yikes!). Thus a formula would help.

AMOUNT (FUTURE VALUE):	COMPOUND INTEREST SITUATION
$A =$	
and	
$r =$	Rate per year (as a decimal)
$n =$	Number of compounding periods per year
$P =$	Principal or Present Value
$A =$	Amount Due or Future Value
$t =$	time in years

Calculate the future value of an investment account when \$4000 is deposited earning 6% interest, compounded semiannually, for 2 years.

Find the value of \$1,000 invested at 8% for 5 years compounded:

- a. Annually
- b. Semiannually
- c. Quarterly
- d. Monthly

Notice how the interest increases more dramatically from annual to monthly compounding. However, this increase begins to taper off as the number of compounding periods increases – indicating that the interest earned will approach a limit. This limit is when you have a *continuous compounding* of your investment. We will NOT be covering this concept in this course.

EXAMPLE

How much interest is earned in 2 years on \$400 deposited in an account paying 6% interest, compounded quarterly?

To save for their child's education, a couple deposits \$3,000 into an account that pays 7% annual interest compounded daily. Find the amount in the account after 8 years.

PRESENT VALUE

The present value of an investment is the original principal invested, or the value of the investment before it earns any interest. We use present value to determine how much money must be invested today in order for an investment to have a specific value at a future date.

EXAMPLES

How much should you invest today at 10% compounded quarterly to have \$8,000 toward the purchase of a car 5 years from now?

How much money should be invested in an account that earns 9% interest, compounded semiannually, in order to have \$20,000 in 5 years.

One of the challenges with compounding rates and periods is that they cannot be compared – thus as an investor, it is difficult to make a decision as to which investment is the wisest. Which has the higher return? Use a set amount A (perhaps \$100) and set time period t (perhaps 1 year).

Bank	Rate	Compounded	Comparison
PNC	6.96%	daily (360)	<i>Lower rate, but more compoundings</i>
IUS Credit Union	6.97%	quarterly	<i>Higher rate, but less compoundings</i>

EFFECTIVE ANNUAL YIELD

The **Effective Annual Yield** is the rate that a bank would have to offer if the principal will be invested using simple interest ($I = Prt$) instead of compound interest.

EXAMPLE

Suppose you deposit \$1000 in a savings account that pays 6% interest compounded quarterly.

- a. What is the balance at the end of 1 year?

- b. What is the *effective annual yield*? That is, what is the rate that would have been paid by the bank if the amount had been invested using simple interest?

FINDING THE INTEREST RATE

Use the compound interest formula to solve for r given: $A = \$2,500$, $P = \$2000$, $n = 1$, and $t = 5$. Round to the nearest 100th of a percent.

You are planning a vacation two years from now. You buy a CD for \$1,200 that you will cash in for your trip. What annually compounded interest rate must you obtain on the CD if you need \$1,500 for the trip?