Compounding Interest

Objectives

1. Find compound interest and compound amount
2. Determine number of periods and rate per period
3. Find values in the interest table
4. Use the formula for compound interest to find the compound amount
5. Find the effective rate of interest

Objective 1: Find compound interest and compound amount

Introduce concept of compounding interest. Be sure to first do an expanded example, and then do one with exponential notation.

Example 1

Suppose that Tony and Tanya will need $8000 for a down payment for a house. If they invest $5500 in an account earning 5% per year compounded annually, find (a) the future amount in 4 years; (b) the amount of compound interest earned; (c) the excess between compound and simple; and, (d) how much more money they need for their goal.

Objective 2: Determine the number of periods and rate per period

Explain the difference between nominal and applied interest rates. Reference the table on page 483 to demonstrate these notions.

Go over example 2.

Compound Amount = M = P(1 + i)^n.

Example 3

A man from Ontario invests $2500 in an account paying 6% interest compound semiannually for 5 years. (a) Estimate the future value using simple interest, then (b) find the compound amount.

Objective 3: Find values in the interest table

Go over how to read the table and how to find the values with a calculator.
Objective 4: Using the compound interest formula

Work through some examples and discuss how the more often the money is compounded, the more interest is accrued.

Objective 5: Find the effective rate of interest

Biggest key: If interest is compounded more often than annually, the actual rate is more than the nominal rate.

Daily Continuous Compounding

Objectives

1. Define passbook account
2. Calculate interest compounded daily
3. Find compound interest for time deposit accounts
4. Determine the penalty for early withdrawal
5. Find the compound amount with continuous compounding

Objective 1: Define passbook account

A passbook account is a savings account.

Objective 2: Calculate interest compounded daily

Discuss example 1, but work through examples 2, 3 and discuss how to do them.

Objective 3: Find compound interest for time deposit accounts

What are time deposit accounts? How should they be used? Show how to use the table to find the multiplier for principals.

Objective 4: Determine the penalty for early withdrawal

When an account holder agrees to leave money in an account for a certain length of time, they pay a penalty for early withdrawal. Look at the rules on page 496 to understand
how the penalty works.

**Objective 5: Find compound amount with continuous compounding**

Introduce the notion of \( e \): how it is formed, the approximate amount, the interest formula using it. Do some examples to familiarize everyone with it.

MATH 109 - Chapter 13 Section 3 Notes
January 18, 2011

**Finding Time and Rate**

**Objectives**
1. Find time if given rate, principal, and maturity value
2. Find rate if given time, principal, and maturity value
3. Using more than one table to solve interest problems

**Objective 1: Find Time if given R, P, and M**

Many of these problems would require advanced algebra to solve, but clever use of the tables can also produce results. Let’s see how to find the time needed for desired growth in this example.

**Example 1**

James Thompson needs $45,000 to start a small music store but only has $29,000. How long will he have to wait if he puts his money into an account that earns 10% compounded annually?

**Solution Sketch**

Recall that \( M = P(1 + i)^n \). Thus, if we divide by \( P \), we obtain

\[
\frac{M}{P} = (1 + i)^n.
\]

Using this formula and the tables in Appendix D, we can find the \( n \) value needed.

**Objective 2: Find R if given T, P, and M**

Here we will use the same method as before, but we must look through multiple tables until we find the correct one.

* Go over Example 3 and how to find the appropriate annual rate.

**Objective 3: Using more than one table**

Sometimes our the percentage rate for our investments change and we need to know what this does to our money. The following example shows how to use multiple tables to find the answers we need.

**Example 4**
Jean King places $2500 in an account paying 6% compounded quarterly. After 4 years, the rate drops one percentage point, compounded semiannually. Find the amount in her account after 7 years.

Solution Sketch
First, we need to find how much was in her account after 4 years. Then, we treat that amount as the starting point with the new rate and repeat the procedure for a time of 3 years. The answer to this last part will be the amount after 7 years.

MATH 109 - Chapter 13 Section 4 Notes
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Present Value at Compound Interest
Objectives
1. Review the meaning of future and present value
2. Find the present value

Objective 1: Review future vs. present value
Recall that present value is the amount that must be placed in now to see a certain return after a specified length of time.

Objective 2: Find the Present Value
A quick reworking of our formula for $M$ results in

\[ P = \frac{M}{(1 + i)^n}. \]

Finding the present value is a must if a person has a goal in mind. Such scenarios include retirement planning, structured settlements, and asset liquidation. Go over examples 1 and 2, a problem like example 3 would be a wonderful exam question.