

Financial Algebra Unit 3-5 Lesson Plan

Text: *Financial Algebra* by Robert Gerver and Richard Sgroi

Unit number and title: Unit 3-5 Compound Interest Formula

Developed by: David Sandefur

Date: June 26, 2010

Short Description:

Calculating compound interest using the simple interest method is tedious when there are numerous period. This unit will cover how to use the power of mathematics to turn this long procedure into a relatively small amount of work.

LESSON PLAN

TEACHER: Teacher Prep/ Lesson Plan

- **Essential Question**

What are the advantages of using the compound interest formula?

- **Lesson Objectives**

The student can:

1. Become familiar with the derivation of the compound interest formula.
2. Make computations using the compound interest formula.

- **Statement of pre-requisite skills needed**

Skills taught in:

- Unit 3-3 Savings Accounts
- Unit 3-4 Explore Compound Interest

- **New Vocabulary:**

Compound Interest Formula	This relates principal, interest rate, the number of times interest is compounded per year, and the number of years the money will be on deposit to give the ending balance.
Annual Percentage Rate (APR)	The interest rate paid per year or charged per year.
Annual Percentage Yield (APY)	The simple interest rate that would be required to give the same dollar amount of interest that the compounding gave.

- **State Standards addressed:**

Math: 1.1.4; 1.2; 2.2.2; 3.3.2

Algebra 1: A1.1.A; A1.1.E; A1.3.B; A1.7.C

Algebra 2: A2.1.A; A2.1.C; A2.8.A; A2.8.B; A2.8.C; A2.8.D; A2.8.E; A2.8.F

Reading: 1.2.2; 2.1.4; 2.1.5; 2.3.4

Common Core Standards: Algebra – Seeing Structure in Expressions A-SSE;

Functions – Interpreting Functions F-IF

- **Set-up information (Remind students to follow these basic rules.)**
- Be Prepared to work
- No Teasing
- Proper Computer Usage

- **Teacher Assessment of student learning (scoring guide, rubric)**

Informal Assessments:

1. Walk around
2. Thumbs up or down
3. Homework

Formal Assessments:

1. End of Unit test

- **Summary of learning**

1. Introduce the vocabulary to the students.
 - a. Give the vocabulary list without definitions
 - b. Give the definitions to the vocabulary list
 - c. Discussion about each term of the vocabulary
2. Ask:
 - a. What are the advantages of using the compound interest formula?
 - b. How difficult would it be for a bank to do daily compounding for thousands of customers?
3. Work on Examples to Strengthen skills
 - a. Example 1, page 144
 - b. Example 2, page 145
 - c. Example 3, page 146
 - d. Example 4, page 147
4. Check for Understanding
 - a. Check Your Understanding 1, page 145
 - b. Check Your Understanding 2, page 145
 - c. Check Your Understanding 3, page 146
 - d. Check Your Understanding 4, page 147
5. Extend Your Understanding
 - a. Extend Your Understanding 1, page 145
 - b. Extend Your Understanding 2, page 146
 - c. Extend Your Understanding 3, page 147
6. Assess with Applications

REACHING ALL LEARNERS – Differentiated Instruction for students with

Developing Knowledge	On-level Knowledge	Advanced Knowledge
<input type="checkbox"/> Needs help working Example 1, page 144 (Group work)	<input type="checkbox"/> Able to work Example 1, page 144 without assistance	<input type="checkbox"/> Able to create additional problems like Example 1, page 144
<input type="checkbox"/> Needs help working Example 2, page 145 (Group work)	<input type="checkbox"/> Able to work Example 2, page 145 without assistance	<input type="checkbox"/> Able to create additional problems like Example 2, page 145
<input type="checkbox"/> Needs help working Example	<input type="checkbox"/> Able to work Example 3, page	<input type="checkbox"/> Able to create additional

3, page 146 (Group work)	146 without assistance	problems like Example 3, page 146
<input type="checkbox"/> Needs help working Example 4, page 147 (Group work)	<input type="checkbox"/> Able to work Example 4, page 147 without assistance	<input type="checkbox"/> Able to create additional problems like Example 4, page 147
<input type="checkbox"/>	<input type="checkbox"/> Able to work the Check Your Understanding problems, pages 144-147	<input type="checkbox"/> Able to work and explain the Check Your Understanding problems, pages 144-147
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Able to work the Extend your Understanding on pages 145-147
<input type="checkbox"/> Exit Slip consisting of answering the question: How does today's class relate to me?	<input type="checkbox"/> Exit Slip consisting of answering the question: How does today's class relate to me?	<input type="checkbox"/> Exit Slip consisting of answering the question: How does today's class relate to me?

- **Optional activities**

Hands-on Labs

- **Career Applications**

Banker	Venture Capitalist	Economist
Builder	Investor	Insurance Agents
Real Estate Agents	Lawyer	Doctor
Teacher	Laborer	

- **Evaluation of Lesson Plan**

What went well?

What did not go as well as planned?

What would I keep and what would I toss? Why?

How well did the students master the skills? Will we need to review this in order for them to remember the information long-term?

<https://wa-appliedmath.org/>

Financial Algebra Compound Interest Lab

Text: *Financial Algebra* by Robert Gerver and Richard Sgroi

Chapter: 3 – Banking Services

Unit number: 3-5 **Title of unit:** Compound Interest Formula

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Date: June 27, 2012

Attach the Following Documents:

1. Lab Instructions
2. Student Handout(s)
3. Rubric and/or Assessment Tool

Short Description (Be sure to include where in your unit this lab takes place):

This lab is to take place after the completion of Unit 3-5 in the Financial Algebra book. The purpose of this lab is to develop a deeper understanding of compound interest to facilitate a results-oriented process that is focused on improving the academic achievement and functional performance of the student in order to facilitate the student's movement from school to post-school activities, including postsecondary education/training, employment, and if appropriate, independent living skills.

How Do I Know If I Am Getting the Best Interest Rate on My Money

LAB PLAN

TEACHER: (*Teacher Prep/Lab Plan*)

➤ **Lab Objective**

For the student to be able to distinguish the difference between the types of interest and how it is compounded, from lending institutions and be able to determine which institution provides the best annual percentage rate (APY).

➤ **Statement of prerequisite skills needed** (*Vocabulary, Measurement Techniques, Formulas, etc.*)

Understand the simple interest formula $I = PRT$

Understand the compound interest formula $B = P \left(1 + \frac{r}{n}\right)^{nt}$

Understand the APY formula $APY = \left(1 + \frac{r}{n}\right)^n - 1$

➤ **Vocabulary**

Balance	Savings Account
CD (Certificate of Deposit)	Interest
Principal	Rate
Time	Spreadsheet

➤ **State Standards addressed:** (*Highlight "Green" Standards, you may use your District's Power Standards if applicable*)

▲ **Math:** 1.1.4; 1.2; 2.2.2; 3.3.2

- ⤴ **Reading:** 1.2.2; 2.1.4; 2.1.5; 2.3.4
- ⤴ **Algebra 1:** A1.1.A; A1.1.E; A1.3.B; A1.7.C
- ⤴ **Algebra 2:** A2.1.A; A2.1.C; A2.8.A; A2.8.B; A2.8.C; A2.8.D; A2.8.E; A2.8.F
- ⤴ **Common Core Standards:** Algebra – Seeing Structure in Expressions A-SSE; Functions – Interpreting Functions F-IF
- ⤴ **Leadership: Teamwork and Presentation Skills**
- ⤴ **SCAN Skills/Workplace Skills:**
 - ⤴ Basic Skills: A, C, and D
 - ⤴ Arithmetic Skills: A, B, C, and D
 - ⤴ Mathematics Skills: B and D
 - ⤴ Thinking Skills: Creative Thinking, Decision Making, and Problem Solving

➤ **Teacher Preparation:** (*What materials and set-up are required for this lesson?*)

- ⤴ **Materials:**
Computers, Spreadsheet Program, Printer, Calculators, Paper, Pencils, Rate Quotes from several (at least 4) banks or credit unions that service your area, Internet
- ⤴ **Set-Up Required:**
No new room or equipment setup needed.

➤ **Lab Organizational Strategies:**

- ⤴ **Grouping/Leadership/Presentation Opportunities:**
Students will pair up with a student of their choice. However, you as the teacher reserve the right to change these pairings on the needs of the students and the class.
- ⤴ **Cooperative Learning:**
Students will work together to solve the problems and then collectively select the best solution for them.
- ⤴ **Expectations:**
Students will learn to analyze data and make informed decisions based on that data.
- ⤴ **Time-line:**
2 to 3 class periods depending on the length of the class period and the skill levels of the students.

➤ **Post Lab Follow-Up/Conclusions** (*to be covered after student completes lab*)

- ⤴ **Discuss real world application of learning from lab:**
 - ⤴ Why would it be important to know which bank or institution was giving you the best return on your invested money?
 - ⤴ Does initial look at the quoted rates actually tell you which institution is best? Why or why not?

⤴ **Career Applications:**

Banker	Venture Capitalist	Economist
Builder	Investor	Insurance Agents
Real Estate Agents	Lawyer	Doctor
Teacher	Laborer	

- ⤴ **Optional or Extension Activities:**
Creation of spreadsheets that will calculate: simple interest, compound interest, and APY. These can then be used by the students or others to do their calculations.

Research additional institutions on the internet and get their rates of returns. Include the additional institutions in the solving of the problem.

Give each group a different amount of money to deposit.

LAB TITLE: How Do I Know If I Am Getting the Best Interest Rate on My Money

STUDENT INSTRUCTIONS:

➤ Statement of problem addressed by lab

You have just received an insurance claim payment of \$5,000. You want to put this money to work for you by earning interest at a savings institution. You are not sure which one to put the money into. So you enlist the help of your classmate.

1. You and your classmate are going to choose 5 financial institutions.
2. You will use the data from those institutions to create a table and put the information about the institutions into the table.
3. Choose the best institute for you money by calculating the APY for the institutions.
4. Then estimate the balance if your money is invested for a period of 6 years.

➤ Grouping instructions and roles

1. Choose one classmate to be your partner
2. Decide which institutions from the list you will use

➤ Procedures – steps to follow/instructions

1. Using the institutes that you have chosen, select the time periods and interest rates that you will use.
2. Calculate the APY for each institution, time period, and interest rate based on monthly compounding.
3. Put your information and calculation into a table. HINT: Include Institution, Interest Rate, and APY in the table.

➤ Outcome instructions

1. You will create a chart in the form of a table with your information.
2. You will then indicate which institution you will put your money with. This is by a written recommendation.

➤ Assessment instructions

1. Turn in your completed table that includes your calculations.
2. Turn in your recommendation of institution for your investing.
3. Grading will be on the work turned in.

Student Handouts:

Institutions and their rates:

Institution	Product	Interest Rate	Min to earn Interest Rate
Discover Bank	3 Month CD	0.45 %	\$2,500
Regal Financial Bank	3 Month CD	0.35 %	\$1,000
Bank of Internet USA	3 Month CD	0.15 %	\$1,000
Citibank	3 Month CD	0.15 %	\$10,000
HSBC Advance	3 Month CD	0.10 %	\$1,000
Zions Bank	3 Month CD	0.10 %	\$1,000
Seattle Bank	3 Month CD	0.10 %	\$1,000
CIT Bank	6 Month CD	0.45 %	\$1,000
Discover Bank	6 Month CD	0.80 %	\$2,500
Regal Financial Bank	9 Month CD	0.65 %	\$1,000
Pentagon Federal CU	6 Month CD	0.40 %	\$1,000
Seattle Bank	9 Month CD	0.30 %	\$1,000
HSBC Advance	4 Month CD	0.10 %	\$1,000
Aurora Bank FSB	6 Month CD	0.10 %	\$1,000
CIT Bank	12 Month CD	1.06 %	\$1,000
Discover Bank	18 Month CD	1.00 %	\$2,500
Union National Bank	12 Month CD	0.93 %	\$5,000
Pentagon Federal CU	12 Month CD	0.90 %	\$1,000
Regal Financial Bank	12 Month CD	0.85 %	\$1,000
Seattle Bank	18 Month CD	0.45 %	\$1,000
HSBC Advance	12 Month CD	0.20 %	\$1,000
Aurora Bank FSB	12 Month CD	0.15 %	\$1,000
CIT Bank	36 Month CD	1.42 %	\$1,000
Pentagon Federal CU	84 Month CD	2.40 %	\$1,000
Discover Bank	60 Month CD	1.80 %	\$2,500
Seattle Bank	60 Month CD	1.45 %	\$1,000
Union National Bank	36 Month CD	1.29 %	\$5,000

Student Selected Institutions Data Chart

Institution	Time Period	Interest Rate

Web Sites:

<http://www.mathsisfun.com/money/compound-interest.html>

Simple examples, definitions, and formulas that are more student oriented in its delivery language.

<http://www.brightstorm.com/math/algebra-2/inverse-exponential-and-logarithmic-functions/compound-interest-continuously/>

Video on Continuous Compound Interest. Provides an additional method of information delivery to the students.

<http://math.about.com/library/weekly/aa042002a.htm>

Explains Compound Interest and give the formula for calculating compound interest.

<https://khan-academy.appspot.com/finance-economics/core-finance/v/introduction-to-compound-interest-and-e>

Video that is the introduction to compound interest and e .

<https://wa-appliedmath.org/>

Unit 3-5: Compound Interest Formula

Quiz Answer Key

1. Solution

Use the Compound Interest Formula to solve.

$$B = P \left(1 + \frac{r}{n}\right)^{nt}$$

$P = \$500$, $r = 0.025$, $n = 4$, $t = 1$

Substitute

$$B = \$500 \left(1 + \frac{.025}{4}\right)^4$$

Solve

\$512.62

2. Solution

Use the Compound Interest Formula to solve.

$$B = P \left(1 + \frac{r}{n}\right)^{nt}$$

$P = 1,235$, $r = 0.0225$, $n = 12$, $t = 3$

Substitute

$$B = \$1,235 \left(1 + \frac{.0225}{4}\right)^{4 \cdot 3}$$

Solve

\$3789.07

3. Solution

Use the APY Formula to solve

$$APY = \left(1 + \frac{r}{n}\right)^n - 1$$

$r = 0.0325$, $n = 52$

Substitute

$$APY = \left(1 + \frac{0.0325}{52}\right)^{52} - 1$$

Solve

.033 or 3.3%

Unit 3-5: Compound Interest Formula Quiz

Answer the following questions on this paper. Show your work as the work will also be a part of the grade.

1. John opens a savings account with \$500 which he earned during the summer mowing lawn. The bank will pay him 2.5% interest for one year, compounded quarterly. Without John adding any more money to his savings account, how much money will he have at the end of one year?

2. Joan makes a deposit in a savings account of \$1,235. The account earns interest at the rate of 2.25, compounded monthly. What is her ending balance after 3 years? Round to the nearest cent.

3. Richard has been given a \$1,000, 1-Year Certificate of Deposit at 3.25 interest compounded weekly. What is Richard's annual percentage yield (APY) to the nearest hundredth of a percent?

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Formulas:

Simple Interest Formula $I = prt$

Compound Interest Formula $B = P \left(1 + \frac{r}{n}\right)^{nt}$

APY Formula $APY = \left(1 + \frac{r}{n}\right)^n - 1$

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Unit 3-5: Compound Interest Formula

Quiz 2 Answer Key

1. a. Solution

Use the Compound Interest Formula to solve.

$$B = P \left(1 + \frac{r}{n}\right)^{nt}$$

$P = \$15,000$, $r = 0.025$, $n = 4$, $t = 14$

Substitute

$$B = \$15,000 \left(1 + \frac{.025}{4}\right)^{14}$$

Solve

\$16,367.17

b. Solution

Use the Compound Interest Formula to solve.

$$B = P \left(1 + \frac{r}{n}\right)^{nt}$$

$P = \$15,000$, $r = 0.025$, $n = 4$, $t = 20$

Substitute

$$B = \$15,000 \left(1 + \frac{.025}{4}\right)^{20}$$

Solve

\$16,990.61

2. Solution

Use the Simple Interest Formula to solve.

$$I = prt$$

$p = 1,000$, $r = 0.0325$, $t = \frac{1}{4}$

Substitute

$$I = \$1000(.0325)\left(\frac{1}{4}\right)$$

Solve

\$8.12

3. Solution

Use the APY Formula to solve

$$APY = \left(1 + \frac{r}{n}\right)^n - 1$$

$r = 0.0465$, $n = 12$

Substitute

$$APY = \left(1 + \frac{0.0465}{12}\right)^{12} - 1$$

Solve

4.75%

Unit 3-5: Compound Interest Formula

Quiz 2

Formulas:

Simple Interest Formula $I = prt$

Compound Interest Formula $B = P \left(1 + \frac{r}{n}\right)^{nt}$

APY Formula $APY = \left(1 + \frac{r}{n}\right)^n - 1$

Answer the following questions on this paper. Show your work or the key strokes you used on the calculator as this will also be a part of the grade.

1. John and Cindy receive \$15,000 in gifts from relatives for their wedding. They deposit the money into an account that pays 2.5% interest, compounded monthly.
 - a. What will be their balance at the end of 14 years?

- b. What will be their balance at the end of 20 years?

2. Alex opens a savings account with \$1,000 that pays 3.25% interest, compounded quarterly. How much interest does Alex earn in the first quarter?

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3. The neighborhood bank has a special 4.65% APR for deposits over \$5,000. Ray has \$26,000 to invest for one year. The interest is compounded monthly. Find the annual percentage yield for Ray's account to the nearest hundredth of a percent.

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