WAMC Lab   Financial Algebra Chapter 3-5 Compound Interest

Math Concept(s): Compound Interest Formula
Source / Text: Financial Algebra Southwestern Cengage Learning 2013, 2011
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Date: Summer In-service 2013

Attach the following documents:

Lab Instructions:

Student Handout(s)

Rubric and/or Assessment Tool

Short Description (Be sure to include where in your instruction 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.

Lab Plan

Lab Title: How do I know If I Am Getting The Best Interest Rate For My Money?

Prerequisite skills:

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

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).

Standards:

Common Core Standards:

Domain: Seeing Structure in Expressions A-SSE3c
Big Idea (Cluster): Write expressions in equivalent forms to solve problems
Common Core State Standards: Use properties of exponents to transform expressions for exponential functions.
Domain: Interpreting Functions F-IF8b
Big Idea (Cluster): Analyze functions using different representations
Common Core State Standards: Use the properties of exponents to interpret expressions for exponential functions.

Standards for Mathematical Practice:

Mathematical Practice(s):
- MP.1 Make sense of problems and persevere in solving problems.
- MP.5 Use appropriate tools strategically.
- MP.7 Look for and make use of structure.

Reading:
-

Writing:
-

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)
☐ Global Awareness   ☒ Financial/Economic/Business/Entrepreneurial Literacy   ☐ Civic Literacy
☐ Health/Safety Literacy   ☐ Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION	INFORMATION, MEDIA & TECHNOLOGY SKILLS	LIFE & CAREER SKILLS	Productivity and Accountability
Creativity and Innovation	Information Literacy	Flexibility and Adaptability	☐ Manage Projects
☐ Think Creatively	☒ Access and Evaluate Information	☐ Adapt to Change	☒ Produce Results
☒ Work Creatively with Others	☒ Use and manage Information	☐ Be Flexible	Leadership and Responsibility
☐ Implement Innovations	Media Literacy	Initiative and Self-Direction	☐ Guide and Lead Others
Critical Thinking and Problem Solving	☐ Analyze Media	☐ Manage Goals and Time	☐ Be Responsible to Others
☒ Reason Effectively	☐ Create Media Products	☐ Work Independently	
☒ Use Systems Thinking	Information, Communications and Technology (ICT Literacy)	☐ Be Self-Directed Learners	
☒ Make Judgments and Decisions	☒ Apply Technology Effectively	Social and Cross-Cultural	
☒ Solve Problems		☒ Interact Effectively with Others	
Communication and Collaboration		☒ Work Effectively in Diverse Teams	
☒ Communicate Clearly			
☒ Collaborate with Others			

Teacher Preparation: (What materials and set-up are required for this lab?)
Materials
- Computers
- Excel
- 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 Organization Strategies:
Grouping/Leadership/Presentation Opportunities:
- Students will pair up with a student of their choice. However, you as the teacher reserve to 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.

Timeline:
- 2 to 3 class periods depending on the length of the class period and the skill levels of the students.

<u>Post Lab Follow-Up/conclusions:</u>
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?
- 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: <u>How Do I Know If I Am Getting the Best Interest Rate on My Money</u>

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.
3. Create an equation for each of your 5 institutions
4. Create a graph of the 5 equations.
5. You will make a digital poster to present your findings and decisions to the class.
   a. What will you save for?

➢ Assessment instructions

1. Turn in your completed table that includes your calculations.
2. Turn in your recommendation of institution for your investing.
3. Present to the class using PowerPoint or some other digital software to share you digital poster.
4. Grading will be on the work turned in and presented.

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	APY

Name: _____ Date: _____ Period: _____

Homework Quiz 3-5 Compound Interest Formula

1) Roxana and Rafael just got married. They received $5,125 in cash gifts from their family and friends. Since they want to save towards the down payment on a new house, they decide to put this money into a CD for 5 years that earns 3.2% interest compounded daily. How much money will they have after 5 years.

2) Lake Washington High School receives a large donation of $500,000 from a successful alumnus.
   a. How much would the account earn in one year of simple interest at a rate of 4.25%?

   b. How much would the account earn in one year if the interest is compounded daily at the interest rate of 4.25%?

   c. How much more interest is earned by compound daily as compared to simple interest?

Homework Quiz 3-5 Compound Interest Formula

1) Roxana and Rafael just got married. They received $5,125 in cash gifts from their family and friends. Since they want to save towards the down payment on a new house, they decide to put this money into a CD for 5 years that earns 3.2% interest compounded daily. How much money will they have after 5 years.

$6,014.20

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

p=$5,125
r=0.032
n=365
t=5

2) Lake Washington High School receives a large donation of $900,000 from a successful alumnus.

   a. How much interest would the account earn in one year of simple interest at a rate of 4.25%?

   Interest Earned = **$38,250.00**

$$I = prt$$

p=900,000
r=0.0425
t=1

   b. How much would the account earn in one year if the interest is compounded daily at the interest rate of 4.25%?

   Interest Earned = **$39,072.13**

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

p=900,000
r=0.0425
n=365
t=1

   c. How much more interest is earned by compound daily as compared to simple interest?

   $39,072.13 - $38,250.00 = **$822.13**

WAMC Lesson Plan

Name(s): Renee Crow
Lesson Title: 3-5 Compound Interest Formula
Date: 6/25/13
Text: Financial Algebra Southwestern Cengage Learning 2013, 2011 **Lesson Length:** 2 days

Domain: Seeing Structure in Expressions A-SSE3c	
Big Idea (Cluster): Write expressions in equivalent forms to solve problems	
Common Core State Standards: Use properties of exponents to transform expressions for exponential functions.	
Domain: Interpreting Functions F-IF8b	
Big Idea (Cluster): Analyze functions using different representations	
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Mathematical Practice(s):
- MP.1 Make sense of problems and persevere in solving problems.
- MP.5 Use appropriate tools strategically.
- MP.7 Look for and make use of structure.

Content Objectives:	**Language Objectives:**
- I will be familiar with how/why the compound interest formula was formed. - I can use the compound interest formula $B = p\left(1 + \frac{r}{n}\right)^{nt}$ to solve problems.	**Compound**: When interest is added to the principal, so that, from that moment on, the added interest will also earn interest. **Yield**: The amount you earn.
Vocabulary:	**Connections Prior to Learning:**
Compound interest: Interest earned on deposited money <u>plus</u> the previous interest earned. This formula is used for any type of compounding: annually, semiannually, monthly, weekly, daily, and so on. $B = p\left(1 + \frac{r}{n}\right)^{nt}$ **Annual percentage rate** (APR): The interest rate paid per year or changed 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. $APY = \left(1 + \frac{r}{n}\right)^{n} - 1$	- Deep Thinking: How hard would it be for a banker compound interest daily or weekly without computers? - In the last section, we were introduced to the simple interest formula. How could you use *I=prt* to calculate compounded interest.
Questions to Develop Mathematical Thinking:	**Common Misconceptions:**
- Can I figure out a formula to find *p* if I have *I, r, t*? - Can I figure out a formula to find the other variables? - What patterns can I use to make these formulas for the other variables?	- Order of Operations (PEMDAS) - How do I Factor? How do I separate the variable from the other numbers? - How do I revise the formula if I have different pieces of information? - How do I deal with an exponent when I'm factoring? How do I deal with an exponent when I'm separating the variable from the other numbers?

WAMC Lesson Plan

Assessment (Formative and Summative):

- Formative: Watching partner interactions and table teams.
- Formative: Worksheet after solving original problem.
- Summative: Homework Quiz

Materials:

- Books
- Laptops (Excel)
- Online worksheet to fill out.

Instruction Plan:

Launch: How are you going to pay for college? How much will it cost for 4 years of college? How can we use *I=prt* to make decisions about paying for college? Remember, *I=prt* only calculates the simple interest of one segment of time…meaning it doesn't calculate how much you earn on the interest you earn after one segment of time.

- You receive an inheritance from a long lost aunt of $10,000 in an account that pays 3.75% interest compounded daily.
  -You can withdraw this money after 5 years.
  Or
  -You can keep it in the account until it equals the cost of 4 years of college.
- Talk to your elbow partner…How would you solve this problem? What strategies will you use to figure out how much money you will have/need?

Explore:

- Calculate how much money you will have after 5 years.
  -the first day you earn $1.03, how much will you earn the second day?
- Estimate how many years you would have to wait to collect the entire cost of your 4 year college education.
- Introduce the new formula $B = p\left(1 + \frac{r}{n}\right)^{nt}$ to help students explore.

When I observe students: They are working together to solve the problem. They are using *I=prt* to investigate the problem. Perhaps they are using excel to calculate the problem. Maybe they are using the book…or Google.

Questions to Develop Mathematical Thinking as you observe: Is there an easier way to calculate interest that compounds daily or weekly? Where could you look? Do you need more information? Where can you find more information? When would you use *I=prt* and when would you use $B = p\left(1 + \frac{r}{n}\right)^{nt}$?

Answers: After 5 years you have $12,062.19. If you need $200,000 you will have to wait 80 years to withdraw. Use $B = p\left(1 + \frac{r}{n}\right)^{nt}$ and guess and check.

Summarize: We now have two ways to think about calculating interest; Simple Interest and Compound Interest. You can decide for yourself when you want the money.
Practice: Day #1: pg 148-149 #1-15odd, Day #2: pg 148-149 #2-16even
Exit Ticket: How would you explain the difference between Simple Interest and Compound Interest to your aunt?

Career Application(s):

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

21st Century Skills and Interdisciplinary Themes:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)
☐ Global Awareness   ☒ Financial/Economic/Business/Entrepreneurial Literacy   ☐ Civic Literacy
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Creativity and Innovation
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Communication and Collaboration
☒ Communicate Clearly
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INFORMATION, MEDIA & TECHNOLOGY SKILLS
Information Literacy
☒ Access and Evaluate Information
☒ Use and manage Information
Media Literacy
☐ Analyze Media
☐ Create Media Products
Information, Communications and Technology (ICT Literacy)
☒ Apply Technology Effectively

LIFE & CAREER SKILLS
Flexibility and Adaptability
☐ Adapt to Change
☐ Be Flexible
Initiative and Self-Direction
☐ Manage Goals and Time
☐ Work Independently
☐ Be Self-Directed Learners
Social and Cross-Cultural
☒ Interact Effectively with Others
☒ Work Effectively in Diverse Teams

Productivity and Accountability
☐ Manage Projects
☒ Produce Results
Leadership and Responsibility
☐ Guide and Lead Others
☐ Be Responsible to Others