Lesson Plan Title

How Fast Does Compound Interest Compound?

Goals

Students will understand how compound interest works.

Objectives

1. After watching the video *Interest Rates*, students will summarize a definition and example or application of seven personal finance terms, in writing, on a graphic organizer matrix, with a score of at least 6 out of 8 points on the rubric.

2. After watching the video *Compound Interest & Student Loans*, students will calculate Ben's savings account balance by completing a table of values and corresponding computations, with a score of at least 6 out of 8 points on the rubric.

3. Given the opportunity to compare a savings account balance with 5% interest compounded annually and compounded daily, students will explain *why* the balances are different, in writing, using 300 to 400 words.

Target Population

This lesson will be presented to students in Common Core Algebra 2 course, or equivalent, typically in the eleventh grade. This lesson is created for a 60-minutes math period.

Curriculum Alignment

This lesson satisfies the NYS Common Core Learning Standards for Mathematics: High School Functions: Linear, Quadratic, & Exponential Models (F-LE) strand: *Construct and compare linear, quadratic, and exponential models and solve problems.* [Source]

(F-LE-1) **Distinguish between situations that can be modeled with linear functions and with exponential functions.**
        a)   Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
        c)   Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

(F-LE-3) **Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.**

High School Functions: Linear, Quadratic, & Exponential Models (F-LE) strand: *Interpret expressions for functions in terms of the situation they model.*

(F-LE-5) 5. **Interpret the parameters in a linear or exponential function in terms of a context.**

Lesson Description

Time	Procedures/Strategies Used
22 minutes	**Introduction** Group students together in assigned pairs. Instruct students to sit so they are sharing a table with their partner and can clearly see the screen. Today we will learn about an important mathematical concept in personal finance – compound interest! This type of interest is commonly used for loans and investment or savings accounts. You will recall learning about *simple* interest in our last class and, although they only have one different word, these types of interest grow exponentially at very different rates. Today, we will watch two videos about compound interest and learn some new finance vocabulary. Then, we will calculate compound interest on a $10,000 savings account. The first video today is called *Interest Rates* and was posted to YouTube by Wall Street Survivor, a personal finance channel. It is only 2 minutes long but the pace is very fast, so we will watch it multiple times. Each time we watch, we will have a different goal. We will do Think-Pair-Share, only your 'think' time will include *three* plays of the video. (Navigate to *Interest Rates* video on YouTube.) *THINK* First, we will simply watch the video. Try to get the gist of how interest rates work in the real world. (View #1, 2 minutes Wow! That was a lot of information, words, and math in 120 seconds! So, let's just focus on the *first* topic in the video, interest rates. This time when you watch, write down any finance terms that you hear. (Distribute half-sheet scrap paper to students.) (View #2, first 55 seconds only) Watch it one more time. Listen for the words you have written down and write any words you need to add to your list. (View #3, first 55 seconds only) We will go around the room, with everyone giving us one new term that is on your list until all your terms are written up here. (Write responses on the whiteboard.) (Display graphic organizer matrix on screen.) Here are all the finance terms I heard in the video. Did we get them all? (interest, borrower, interest rate, tuition, borrow money, loan, 5% interest each year) (Discuss, compare, and contrast as needed. Pass out paper copies of matrix.)

	PAIR Pair up with your table partner and summarize this list of terms. You may re-watch the video for information or refer to your eMath packet. 'Summarize' means you will write a definition and example or application for each term in the corresponding row. Each box in the summarize column should have 1 complete sentence. (Set 10-minute countdown timer on screen.) (As teams finish, give each student a colored pencil. Direct them to swap papers, check their partner's summary with the Google Slides of terms and add any missing information to the matrix, writing only with the colored pencil.) *SHARE* We will go around the room with each team reading us their summary of one of these terms. (Reply and discuss as needed.) By the end of class, you will be able to explain how compound interest works and calculate Ben's savings account balance after five years
32 minutes	**Instructional Procedures** [17 minutes] Now we will learn about compound interest; what it is and how it is calculated. Navigate to the video called *Compound Interest & Student Loans*. (Distribute Paul's Student Loans notes page to use while watching the video.) With your partner, watch this video and work through the problems concerning Paul's student loans. There are 2 problems covered in this video, and you want to make note of when *interest compounded annually* is used and *interest compounded daily* is used. (Write these phrases on whiteboard.) This paper should be covered with numbers and notes! (Distribute headphones to those that want them.) (Students independently watch the 12-minute video and discuss what they see with their partner. Continuously circle around room, asking individual questions, answering questions, and checking for understanding by looking at their written work.) [15 minutes] Remember Ben from the first video today? Now you will help him calculate the amount of interest he earned from the savings account referenced in the first video. Let's re-watch the second half of this video on compound interest. (Navigate to *Interest Rates* video on YouTube, start at 0:55.) (Display Ben's scenario as a question on the screen.) Here is the situation you will be figuring out: Imagine Ben has saved up $10,000, which he keeps in a savings account at the bank. The bank pays Ben an interest rate in exchange for keeping his money with them.

	1) If the interest rate is 5% compounded **annually**, how much money will Ben earn on his $10,000? Calculate Ben's savings account balance at the end of year 1, year 2, year 3, year, 4 and year 5. 2) If the interest rate is 5% compounded **daily**, how much money will Ben earn on his $10,000? Calculate Ben's savings account balance at the end of year 1, year 2, year 3, year, 4 and year 5. (Distribute Ben's Savings Account questions. Continuously circle around room, asking individual questions, answering questions, and checking for understanding by asking to see their work on #1 and #2.)
6 minutes	**Closure** As we experienced today, calculating compound interest is a multi-step problem. Next class, we will look at scenarios where using the compound interest formula in the only option. For example, we will calculate the balance say at year 20, without having to find years 0 through 19 first. Understanding how compound interest is compounded is an important part of maintaining your personal finances. Let's consider some ways this math will help you now and in the future. How will this knowledge help you in life? (Being informed about loans in your financial aid packages, what to consider when taking out a car loan, understanding promotional mailings from credit card companies, avoiding default, foreclosure, and bankruptcy. Etc.) (Navigate to the Exit Ticket in Google Forms.) Please use what you learned today to answer the questions on this Exit Ticket. (Collect graphic organizer matrix and Ben's saving account problems as students leave to use in preparation for next lesson.)

Supplemental Materials/Links

Interest Rates video

Graphic organizer matrix in Google Docs

Google Slides of terms and summaries

Compound Interest & Student Loans video

Paul's Student Loans notes page in Google Docs

Ben's Savings Account questions in Google Docs

Exit Ticket in Google Forms

Assessment of Students

I will evaluate the learning that should result from this lesson using the 4-point rubric below. It measures success against the 4 criteria set up by the objectives. Full credit in this rubric is 16 points and 11 out of 16 points is considered a passing grade. (Measures of success are elaborated on in the next section.)

Compound Interest Rubric

Criteria	4	3	2	1
Summarizes a definition for each financial term in writing on a graphic organizer	Seven (7) terms are correctly defined	5 to 6 terms are correctly defined	3 to 4 terms are correctly defined	0 to 2 terms are correctly defined
Summarizes an example or application for each financial term in writing on a graphic organizer	One (1) accurate example or application is provided for all 7 terms, using correct terminology	One (1) accurate example or application is provided for 5 to 6 terms, using correct terminology	One (1) accurate example or application is provided for 3 to 4 terms and/or 3 or fewer errors in terminology usage	No examples are provided and/or more than 3 errors in terminology usage
Computes compound interest and adds it to previous balance in consecutive years	Five (5) years of compound interest are accurately calculated using the previous year's balance and/or the formula	3 or 4 years of compound interest are accurately calculated using the previous year's balance and/or the formula	1 or 2 years of compound interest are accurately calculated using the previous year's balance and/or the formula, and/or 1 or 2 computational errors	No years of compound interest are accurately calculated using the previous year's balance and/or the formula, and/or 3 or more computational errors
Interprets calculations to display yearly values in a table	Five (5) years of compound interest are accurately interpreted and displayed	4 to 6 years of compound interest are accurately interpreted and displayed	1 to 3 years of compound interest are accurately interpreted and displayed	No years of compound interest are accurately interpreted and displayed

Evaluation of Lesson

I will know the lesson was a success if 80% of students earn 13 of the 16 possible points on the Language of Algebra rubric. In this student cohort, claiming success would mean that 24 students earned a grade of 81% or higher on this assignment.

Within their work on Ben's savings account scenario, student understanding will be evident by:
1) accurately converting interest rate from percent to decimal
2) multiplying principle x interest rate
3) adding principle + interest amount
4) using the new amount for the next year
5) completing table of values for years 1 through 5

After completing the closure section of the lesson, I will direct students to respond to the following question in writing: Based on your work with Ben's money, compare a savings account balance with 5% interest compounded annually and compounded daily students. Explain WHY the balances are different.

Responding to this question accurately and completely, and utilizing financial terminology in their writing, will indicate each students' overall comprehension of compound interest, independent of being able to do the math or follow the formula. I will use their responses to prepare for the next lesson and to know if more instructional time should devoted to conceptual understanding of compound interest.