

In this assignment, you will explore the concept of compound interest with the help of two online videos.

For questions #1 & #2, watch the 6min Khan Academy video “Introduction to Compound Interest” at <https://www.khanacademy.org/economics-finance-domain/core-finance/interest-tutorial/compound-interest-tutorial/v/introduction-to-compound-interest> (also available at <https://www.youtube.com/watch?v=Rm6UdfRs3gw>).

(Focus on understanding the first four minutes of the video. The end of the video, from approximately the 4:45 mark until the end, mentions a topic that we will cover later in the course: logarithms.)

1. Give short answers (2-3 complete sentences, in your own words) for the following questions. You should be able to answer based on the information presented in the video, but you can also do additional research.

a. What is an interest rate? How is it applied to a deposit in a savings account (or equivalently, to a loan)?

b. What is *compound* interest?

2. The video outlines an example of a \$100 deposit in a savings account which earns 10% interest, compounded annually.

a. Carry out the calculations for this example in more detail by filling in the table below. Start by studying the calculations shown in the first two rows, for $t = 1$ and $t = 2$.

Understand where each number comes from, and what is happening at each step!

Year t	Amount in account at the beginning of year t	Interest added to the account at the end of the year	Amount A_t in the account at the end of year t
1	\$100	$0.1 * \$100 = \10	$A_1 = \$100 + \$100 * (0.1) = \$100 * (1.1) =$
2	\$110	$0.1 * \$110 =$	$A_2 = \$110 + \$110 * (0.1) = (\$110) * (1.1) =$
3	\$	$0.1 * \$ =$	$A_3 =$
4	\$	$0.1 * \$ =$	$A_4 =$
5	\$	$0.1 * \$ =$	$A_5 =$

b. Study the calculations in the rightmost column, and figure out how to complete the following sentence: “To calculate the amount in the account at the end of year t , multiply the amount in the account at the end of the *previous* year by a factor of _____.”

c. Where do the factors 0.1 and 1.1 come from in the calculations? (Hint: Listen to the video closely, and explain in terms of the given interest rate!)

3. Now let’s introduce some algebra. Let the variable A_0 represent the amount of the initial deposit, i.e., the amount in the account at time $t = 0$ (often called *the principal*), and let r represent the interest rate (represented as a decimal). Complete the table by finding expressions for A_3, A_4, A_5 in terms of A_0 and r :

Year t	Amount at the beginning of year t	Interest added at the end of the year	Amount A_t at the end of year t
1	A_0	$r * A_0$	$A_1 = A_0 + rA_0 = A_0(1 + r)$
2	A_1	$r * A_1$	$A_2 = A_1 + rA_1 = A_1(1 + r) = A_0(1 + r)(1 + r) = A_0(1 + r)^2$
3	A_3	$r * A_2$	$A_3 =$
4	A_4	$r * A_3$	$A_4 =$
5	A_5	$r * A_4$	$A_5 =$

4. Use your table to write down a formula for the amount A_t in the account at the end of t years. Your formula should be in terms of A_0 , r , and t !

$$A_t =$$

Now watch the 6min video by PatrickJMT titled “Introduction to Compound Interest” (at <http://patrickjmt.com/deriving-the-annual-compound-interest-formula/>; also available at <https://www.youtube.com/watch?v=AwzWp7mWrtg>):

5. The video starts by going through an example with an initial deposit (i.e., principal) of \$10,000 and interest rate of 6%, i.e., $r = 0.06$. Understand each step of this example, then write down the general formula PatrickJMT derives from this example:

$$A =$$

6. Compare this formula with the formula you wrote down at the top of the page. Aside from the different variables names, they should be the same! If not, go back and correct your answer to #4.

(Note that PatrickJMT uses A , P , APR and Y where we used A_t , A_0 , r , and t , respectively.)

7. Which of the two videos did you find more useful for learning this mathematics? What did you like or dislike about the videos?