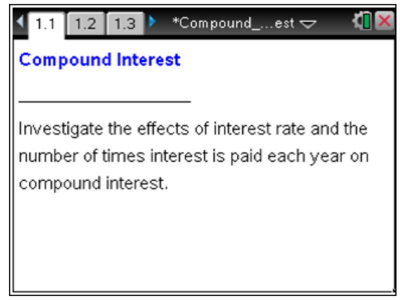
Compound Interest
Student Activity

Name ________________
Class ________________

Open the TI-Nspire document *Compound_Interest.tns.*

The purpose of this activity is to investigate the effects of interest rate and the number of times interest is paid each year on compound interest.



Move to page 1.3.

Press ctrl ▶ and ctrl ◀ to navigate through the lesson.

Let P be the initial amount deposited, r the annual interest rate expressed as a decimal, n the number of times interest is paid each year, and A the total amount in the account at time t (in years). The formula for compound interest is $A(t) = P\left(1+\frac{r}{n}\right)^{nt}$.

1. Suppose $50,000 is deposited in an account paying 2% ($r = 0.02$) per year ($n = 1$). These values have been entered for P, r, and n on Page 1.3.
   - Move to Page 1.4 to see information about this account. Column A displays the total amount in the account after each interest pay period. Column B displays the amount of interest earned after each pay period.
   - Note: row 1 corresponds to the initial deposit; row 2 corresponds to the first pay period, etc.

   a. Explain why the interest earned after each pay period increases.

   b. Use Column A to estimate the number of years until the initial deposit doubles. (Hint: Press ctrl 3 to page down.)

   c. Go back to Page 1.3, and change the interest rate so that the initial deposit doubles after 15 years.

2. Suppose $10,000 is deposited in an account paying 5% ($r = 0.05$) semi-annually ($n = 2$). Enter the values for P, r, and n on Page 1.3.

   a. Complete the following table to find the amount in the account after two years. Change the value of n as necessary on Page 1.3.

n	2	4	6	12	52
$A(2)$					

   As n increases, how do you expect the value of $A(t)$ to change for a fixed value of t?

   b. Explain the meaning of $n = 365$, $n = 365*24 = 8760$, $n = 365*24*60 = 525,600$, and $n = 365*24*60*60 = 31,536,000$.

   c. Insert a Calculator page ,and complete the following table.

n	365	8760	525,600	31,536,000
$A(2)$				

   d. As n increases, how would you explain the compounding period? Explain how the amount in the account changes for a fixed value of t as n increases.

   e. Using your results from Questions 1 and 2, what characteristics would you like in an account in order to earn the most interest after every pay period?

3. Suppose $25,000 is deposited in an account paying 4% ($r = 0.04$) quarterly ($n = 4$).
   Enter the values for P, r, and n on Page 1.3.
   - Move to Page 1.5. Column B displays the amount in the account, A, after each pay period.
   - Column A contains values of the function $c(t) = Pe^{rt}$ for each corresponding pay period, where $e \approx 2.71828\ldots$, the base of the natural logarithm. This function does not depend upon n.
   - Column C contains the difference between the two values for corresponding pay periods.
   - Note: row 1 corresponds to the initial deposit, row 2 corresponds to the first pay period, etc.

   Move or animate the slider on the right side to increase the value of n. Use the slider to change the value of n. As n increases, explain the relationship between $c(t)$ and $A(t)$.

Move to page 2.1.

4. The graph of $y = c(t)$ is displayed as a solid curve, and the graph of $y = A(t)$ is displayed as a dashed curve. Move or animate the slider to change the value of n .
   a. Explain the relationship between the two curves as n increases. Is your answer consistent with your response to question 3? If not, why not?

   Note: you might need to zoom in to examine the relationship between the two curves.

   b. Can you find values for P, r, and n such that $A(t) > c(t)$ for some value of t?

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