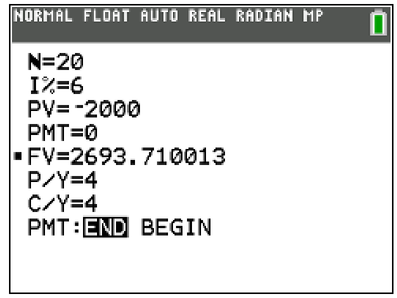
Compound Interest

Student Activity

Name ________________

Class ________________

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.



Let P be the initial amount (**Principal**) 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 $A(t) = P\left(1+\dfrac{r}{n}\right)^{nt}$.

1. Suppose $50,000 is deposited in an account paying 2% ($r = 0.02$) per year ($n = 1$). On your handheld, press **Stat > Edit**, place your cursor at the top of **L$_1$** and press Enter. Now press **2nd > Stat > Ops > 5: seq(**. You will have to enter the following: expression (formula), variable (T), start (0), end (50), and step (1). This will give you the total amount for each of the first 50 years of the investment.

   a. If you subtract each total and its previous total (such as year 2 minus year 1), you will find the interest earned each year. Explain why the interest earned after each pay period increases.

   b. Using your table, estimate the number of years until the initial deposit doubles.

   c. Find 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$).

a. Complete the following table to find the amount in the account after two years.

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

As n increases, explain how you would expect the value of $A(t)$ to change for a fixed value of *t*.

b. Explain the meaning of each of the following:
$n = 365$;
$n = (365)(24) = 8760$;
$n = (365)(24)(60) = 525{,}600$; and
$n = (365)(24)(60)(60) = 31{,}536{,}000$.

c. Complete the following table.

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

d. As n increases, describe 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, describe the characteristics you would 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$). In L_2, enter this information as you did in Problem 1, this will display the amount in the account, A, after each pay period. L_1 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* (number of compounding periods per year) as it is the compounded continuously formula. In L_3, find the difference between the two values for corresponding pay periods by subtracting $L_1 - L_2$.

   As n increases, explain the relationship between $c(t)$ (L_1) and $A(t)$ (L_2).

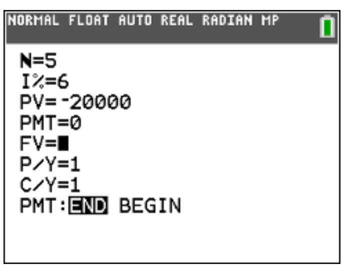
Using the Finance Solver on the handheld:

Insert a calculator page. Press **Menu < 8 Finance, < 1 Finance Solver**. The Finance Solver box will open for you to use in place of the compound interest formula used earlier in this activity.

Sample:

Find the future value of a $20,000 invested for 5 years at 6% compounded annually.

This is what it should look like on the handheld:



Please notice that the **PV** (Principal Value) is entered as -20000 because cash outflows are considered negative. Place your cursor over **FV** and press enter to find the Future Value.

FV = $26,764.51

4. Find the future value of $2000 invested for 5 years at 6% compounded quarterly.

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5. Find the value of $8000 invested for 6 years at 8% compounded monthly.

6. Find how much you would have to invest in a savings account paying 6% compounded quarterly in order to have $3000 in 5 years.