Problem 1 – Introducing Compounding

When we buy cars, take out loans, buy items using credit, and save money in bank accounts, it is beneficial to understand how interest works in these situations. Compounding refers to the number of times per year that interest is calculated and added into the account.

Interest can be compounded on any time schedule, but the most common types are yearly, quarterly, monthly, daily, and continuous. Compounding interest is great for savings because interest is earned on the interest added into the account. It also results in increased income for institutions that grant loans and credit.

On the other hand, frequent compounding with loans and credit cards results in interest being added in frequently and this means that the consumer pays more over time.

Let's say you buy a car at 12% interest per year. While this sounds straight forward, there is more to know.

For a 12% loan with monthly compounding, $\frac{12\%}{12} = 1\%$.

The nominal rate is 12% and 1% of the account balance is added into the account each month. This results in a slightly higher actual percentage rate for interest over the year, known as the effective rate.

Let's say you put money or principal (P), into a savings account that earns 12% interest with monthly compounding. At the end of each month, you'll have ($1 + r$) or 1.01 times the balance at the start of the month. Over a year, this will happen 12 times.

Balance at the end of the year:

$$\begin{aligned} B &= P(1.01)^{12} \\ &= 1.12682503 \end{aligned}$$

If 1.12682503 = 1 + r, then the effective rate is 12.682503%.

To generalize this for any account,

$$\text{Balance} = P\left(1+\frac{r}{n}\right)^{nt}, \text{ where:}$$

P = initial amount in the account

r = nominal rate

n = number of times compounded per year

t = number of years

Name ___________________
Class ___________________

1. Define or explain the following terms.

a. Compounding Interest

b. Nominal Rate

c. Effective (Annual) Rate

2. Using the formula from the first page, answer the following question.

As a college freshman, a student takes out a $10,000 school loan at 8% interest compounded monthly. This loan is unsecured (interest accumulates while in school, but payment is not required until after graduation). What will the value be of this loan after 4 years?

3. What is the effective annual interest rate for this loan?

Problem 2 – Nominal and Effective Rates

Your graphing calculator has some built-in financial features that are helpful in calculating a variety of quantities of interest to consumers.

▸**nom(**effective rate, # compounding periods per year) yields the nominal rate when the effective rate is known.

▸**eff(**nominal rate, # compounding periods per year) yields the effective rate when the nominal rate is known.

Note: Do not convert the rate percents to decimals when using these tools.

These commands can be found by pressing [apps] and selecting **Finance…**.

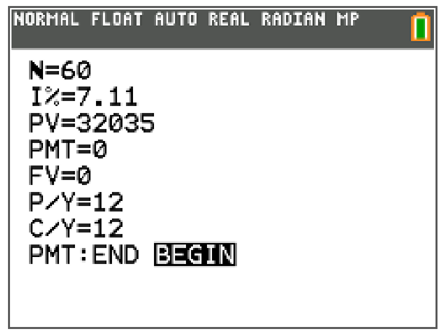
4. Use the finance application to find the effective rate if the nominal rate for a savings account is 4.5% compounded daily.

5. Use the finance application to find the nominal rate for a credit card account if the effective rate is 19.5618% compounded monthly.

Problem 3 – Finance Solver

Your graphing calculator has a built-in finance solver that will help you find payment amounts and other relevant information. It is found by pressing [APPS], selecting **Finance…**, and choosing **TVM Solver…**.

Using the Financial Solver, fill in all fields except payment and with the cursor on the payment field, and press enter to obtain the payment amount.



N = number of payment periods

I% = the annual interest rate

PV = present value

FV = future value or amt due at end of N payment periods

P/Y = payments per year

C/Y = compounds per year

Note: All entries need values. To solve for a specific entry, use the arrow keys to move to the desired entry and press [alpha] [enter]

6. Let's say that you want to buy a convertible that costs $32,035. You are offered a 60-month loan at 7.11%, compounded annually. What will the monthly payment amount be?