Annuities and Amortization

The most common compounding frequencies are:

Compounding	Annually	Semi-Annually	Quarterly	Monthly	Weekly	Daily
# of times per year (m)	1	2	4	12	52	365

Part I
1. Ben would like to have $60,000 available for college in 18 years.
   a. If an account exists earning 7% annual interest compounded annually, how much should be deposited now to have the $60,000 in 18 years?

   $ _____

   b. How much interest is earned? $ _____

   If you don't have all the money available now, you can save a bit each year to reach this goal. This is a type of annuity.

   > An **annuity** is an account into which *regular payments* are made. The annuities in this class are all CERTAIN and SIMPLE, meaning:
   > - The payments are made at fixed time intervals.
   > - The periodic payments are of equal size.
   > - The payments are made at the end of the interval.
   > - The interest is paid at the end of the interval.

   c. Use the TVM Solver to find the amount of the annual payments needed to reach the goal of $60,000.

   N = _____   I% = _____   PV = 0   PMT = _____   FV = _____   P/Y = C/Y = _____

   The amount of the annual payments is _____.

   d. In total, how much money was deposited into the account? 18*PMT = _____

   e.
   $$\frac{}{\text{interest earned}} = \frac{}{\text{final value of account}} - \frac{}{\text{amount depositied}}$$

   f. Why are the interest amounts in parts **b.** and **e.** different?

2. You are saving for retirement by depositing $400 per month in an account that earns 8% annual interest compounded monthly. Determine the total amount in the account and the total interest earned if this is done for 10 years, 30 years and 50 years.

After 10 years, $ _____ total and $ _____ in interest

After 30 years, $ _____ total and $ _____ in interest

After 50 years, $ _____ total and $ _____ in interest

Loans also deal with making payments. A bank loans you money and you make regular payments until you no longer have any of the bank's money. This means that the original value of the loan is the present value (PV) and the future value of the loan (FV) is 0.

3. You find a car advertised for no money down with payments of $199 per month for 72 months. In the fine print you see that the interest is 9% annual interest compounded monthly on the unpaid balance.

   a. What is the purchase price of the car? That is, how large was the loan you took out? $ _____
   b. How much money total will you pay out of pocket? 72*199 = _____
   c. Interest Paid = Amount of Money Repaid – Amount Borrowed = _____

4. Your goal is to retire when you become a multi-millionaire ($2,000,000) so you start saving $100 per week in an account that pays 10% annual interest compounded weekly. If you start at age 23, how old will you be when you retire?

5. A cello costs $998. You pay off the cello by making payments of $39.00 per month for 3 years.

   a. What annual interest rate compounded monthly were you charged (rounded to 4 decimal places)?

   b. How much interest do you pay in total? $ _____

Part II
You take out a $1000 loan. The terms of the 1-year loan are 16% annual interest compounded quarterly on the unpaid balance.

1. How much are the quarterly payments? $ _____

2. How much interest is paid in total? $ _____

3. If the interest was compounded annually, instead, and you just paid the entire loan off at the end of the year, how much would the total interest be? $ _____

4. Why are the answers in **2.** and **3.** different?

Each payment is broken down into two parts; the interest owed is paid first and then the rest of the payment goes towards paying off (paying down) the amount owed (principal).

The amount of interest paid is the largest in your first payment, while nearly all of the last payment goes towards the principal. **Even though the payment is the same each month, the distribution of interest and principal changes with every payment.**

5. What is the periodic, in this case quarterly, interest rate? _____%   *Hint:* There are 4 quarters in a year.