TEAM ASSIGNMENT 1

MAT 305 FALL 2011

1. DIRECTIONS

The groups for this assignment are

Group 1	**Group 2**	**Group 3**
Aaron Ayers	Ryan Anderson	Emily Huffman
Robert Hust	Charles Nelson	Amy Kern
Creighton Nelms	Kristie West	Charles Nelson
Jerry Pirkle	Shannon West	Hannah Ryan
Group 4	**Group 5**	**Group 6**
Joel Huber	Nevada Brown	Kris Katterjohn
Nicole Kershaw	Anna Cubbage	Richard Robbins
Cononiah Watson	Virginia Espejo	

Solve the following problems in a Sage worksheet. So these problems you should write up separately and submit on paper, either typed or written neatly. I strongly recommend LaTeXor Lyx for typing mathematics, *not* Microsoft Word; see me if you'd like to learn a little about either LaTeXor Lyx. (I use Lyx for everything myself.)

Each group should submit one worksheet and one paper. Submit the worksheet by sharing the worksheet from *at least one* group member's account with my account (`john_perry`) at

`https://pax.st.usm.edu:8004/`

If you wish, you may share with all the members of the group who are registered at that website, but this is not necessary. Submit the paper by putting it in my hands, either in class or during office hours. You can slip it under my door, but the custodian may mistake it for trash on the floor. (I seem to have lost a cable that way.)

The due date for this assignment is

2. The Assignment

When you take out a one-time loan of L dollars, interest collects during every *compounding period*. We are interested in computing the amount A remaining on the loan after n compounding periods, when the interest rate during the compounding period is r, and the amount paid at the end of each compounding period is p. You will use Sage to explain some aspects of the corresponding formula and to compute various amounts left on the loan.

1. Verify, via several examples, that for all $x \neq 1$

$$\frac{x^n - 1}{x - 1} = x^{n-1} + x^{n-2} + \cdots + x + 1. \tag{2.1}$$

   Hint: Simplify the left-hand side for several values for n.

2. Explain why this means that the amount remaining on a loan after n compounding periods is

$$A = L \cdot (1 + r)^n - p \cdot \frac{(1 + r)^n - 1}{(1 + r) - 1}. \tag{2.2}$$

   Hint: Use equation (2.1) to explain this in words.

3. Define in Sage an expression for equation (2.2), and use substitution to compute the following.
   a) The amount remaining after 3 years on a loan of \$14,000, compounded once a year at 10%, with yearly payments of \$2,000.
      Hint: Don't forget to convert from decimal to percent.
   b) The amount remaining after 5, 6, 7, and 8 years on a home equity loan of \$24,000, compounded monthly at 0.6875%, with with monthly payments of \$308.67.
      Hint: Don't forget to account for the difference in units (years vs. months).
   c) The amount remaining after 5 years on a car loan of \$24,000, compounded monthly at an annual rate of 5.99%, with monthly payments of \$415.
      Hint: Don't forget to convert the nominal annual rate to a monthly rate.

4. Find a function that indicates the amount p one must pay in each compounding period after borrowing L dollars, compounded during each period at a rate r, in order to owe only A dollars after n compounding periods.
   Hint: Use your algebra skills on equation (2.2).

5. Use that function to determine what monthly payment you must make to pay off a \$210,500 mortgage after 30 years at an annual rate of 5.25%.
   Note: This is only the cost of the loan and the interest. Homeowners often include fire insurance and property taxes, so the monthly payment would actually be higher.