FIL 260: Mortgage Loan Homework Exercises – Problems

This exercise is designed as a "back to basics" approach to time value of money computations, in the context of mortgage loan payment situations. Financial calculator steps are included in many of the accompanying solutions, but in the output you submit for credit you are to work with the appropriate annuity factors or other formulas, not your financial calculator (other than in problem 7, where it is fine to use your calculator to compute the lender's monthly periodic rate of return before converting to APR and EAR values). Too many students know how to compute simple answers with the calculator's function keys, without really knowing what those numbers mean, as evidenced by failure to understand more complicated situations like hybrid loans and the NPV of refinancing. ***[And remember that you can not use graphing calculators on our exams because of security concerns; work these practice problems using a calculator that you can use when you are tested on the mortgage loan computation material.]*** *Show steps for computing each relevant value, and be sure to answer all parts of each question. You are earning credit for working the problems carefully to be better prepared for the exam; points will be taken off for cutting corners. Detailed solutions, that are also intended as a tutorial on mortgage loan mechanics, are provided for each question.*

Please submit a scanned or photographed copy of your carefully hand-written (not typed) answers. (If you take photographs of individual pages with your phone or other device, put only one photo on each page, and please paste all of the pictures into a single Word file in the correct order before submitting. DO NOT submit multiple individual photographs; that kind of submission is very difficult for the instructor to grade.) Upload your submission to Canvas if you can; attach it to an e-mail to the instructor if you can not. Due date and time are shown with the assignment information on Canvas.

1. A borrower can afford to make a monthly principal-plus-interest payment of $1,395. If a local lending institution is willing to provide a fixed-interest rate, fixed-payment mortgage (FRM) loan at a 6.24% annual percentage rate (APR) of interest with equal end-of-month payments over 25 years, how much can the individual afford to borrow?

2. What is the monthly payment on a $175,000 fixed-rate, fixed-payment (FRM) home mortgage loan with a 5.46% stated annual percentage rate (APR) of interest, if payments are to be made at the end of each month for 30 years? Based on this loan's interest rate and number of payment periods, show that a loan payment factor is the sum of the interest rate and sinking fund factor.

3. Show the full amortization schedule for a $275,000 loan with a 4% stated annual interest rate, interest-only payments for the first five years, and a balloon payment at the end of year 6 that includes the year's applicable interest plus all principal owed. Then show the full amortization schedule for a $275,000 loan with a 4% stated annual interest rate and six years of equal year-end payments (the loans described in this problem would not likely be home mortgage loans). Indicate the amount of interest the borrower pays during the second year on the amortization schedule for the second loan, and then compute that year 2 interest amount with the formulas.

4. A borrower obtains a $160,000 fixed-rate, fixed-payment mortgage loan (FRM) with a 4.5% stated annual percentage rate (APR) of interest and end-of-month payments to be made over 20 years. Question a: How much is each monthly payment? [*Remember: on an exam question of this type you must show enough steps to assure the grader that you understand the ideas; hitting the BA II Plus AMORT key and ↓ ↓ ↓ shows no understanding of how interest and principal paid over a specified time period are computed.*]

b. How much interest does the borrower pay during the first *month* of the loan's life?

c. How much interest does the borrower pay during the first *year* of the loan's life? First, compute by hand a complete amortization for the first twelve months of this 20-year loan, and then compute the answer with formulas.

d. If the borrower makes regular monthly payments for three years and then decides to pay the loan off, how much principal is still owed at the end of year 3, and how much in total interest has been paid over this three-year period?

e. If the borrower did not repay the remaining balance at the end of year 3, but rather continued to make payments for the remainder of the 20-year term, how much interest would be paid in year 14?

5. Nine years ago a borrower obtained a fixed-rate, fixed-payment mortgage (FRM) loan. Interest was quoted as a 5.10% Annual Percentage Rate (APR), and equal payments of $1,629.59 were to be made at the end of each month for 25 years. What was the amount borrowed? How much remains owed today? Show how we can compute the unchanging monthly payment if we know what remains owed today even if we do not know the amount originally borrowed; use the example of knowing $213,586.62 is still owed nine years into the 25-year amortization period for this 5.10% APR loan.

6. What is the monthly payment on a $236,000 fixed-rate, fixed-payment (FRM) home mortgage loan with an interest rate represented as a 3.8835% effective annual rate (EAR), if equal payments are to be made at the end of each month for 15 years? What would the accompanying annual percentage rate (APR) of interest be? This question is similar to the first part of question 1, except now the interest rate is presented in EAR rather than APR terms. (Discussing the interest rate in EAR terms is conceptually useful but admittedly not real-world realistic, because while EAR is a more comprehensive measure of a borrower's yearly opportunity cost of the debt financing, the interest rate that federal law requires lenders to quote in making home mortgage loans is an APR application.) Show why we can not instead just compute the annual payment for a 15-year loan with that APR (or EAR) interest rate, and then divide the resulting annual payment by 12 to get the correct monthly payment.

7. A $242,000 fixed-rate, fixed-payment (FRM) home mortgage loan carries scheduled payments of $1,870.09 at the end of each month for 30 years. Set up the equations to compute the effective cost of borrowing, first with zero discount points, and then with the lender charging two discount points as a condition of granting the loan. The payments and number of periods are monthly figures, so the r's in the equations will be monthly figures that you should convert to annual percentage rate (APR) and effective annual rate (EAR) values. (After setting up the equations, it is sensible to compute the monthly r's with Excel® or your financial calculator's I/Y function key.)

8. How long would it take to pay off a $150,000 fixed-rate, fixed-payment home mortgage loan (FRM) with equal end-of-month payments of $1,200 and a 3.3% annual contract interest rate (APR)? What about a $125,000 FRM with unchanging end-of-month payments of $437.50 and a 4.2% annual contract interest rate (APR)? [Find the answers with logarithms; we want everyone to see what your financial calculator is doing when you hit CPT-N.]

9. "Two-step" mortgage loans frequently are "5/25" or "7/23" (the same interest rate and monthly payment for the first five or seven years of a 30-year amortization period, followed by year-to-year changes based on each year's new market interest rate). Let's pretend we are borrowing $290,000 on a "6/24" plan (not commonly seen but certainly not inappropriate); the monthly payments will remain the same for all of years 1-6, based on a 5.16% stated APR interest rate, and then year 7's monthly payment will be computed based on a new, higher predicted 6.12% APR. Compute the monthly payment that applies to years 1 – 6, and the expected monthly payment for year 7.

10. Five years ago a home buyer obtained a $185,000 mortgage loan, which carried a 6.6% stated annual percentage rate (APR) of interest and was to be repaid with equal end-of-month payments over 30 years. Today she would be able to get a 25-year loan with a 5.4% stated APR. Thus she might expect to make level payments over the next 25 years, regardless of whether she continues with the current loan or gets a new one. Origination costs, and other costs such as searching the market and lost time, in connection with getting a new loan would be approximately $9,500. If she has extra cash she can invest it to earn a 4.2% annual percentage rate (APR) of return. What net present value (NPV) would the borrower realize if she refinanced the loan? What would her NPV of refinancing be if she planned to remain in the local area for only seven more years before retiring, selling the house, and moving away?