Math 1090 Mortgage Project

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In this project we will examine a home loan or mortgage. Assume that you have found a home for sale and have agreed to a purchase price of **$198,500**.

Down Payment: Assume that you are going to make a 10% down payment on the house. Determine the amount of your down payment and the balance to finance.

Down Payment $19850.00 Mortgage Amount $178,650

$198,500 x .1 $19,850

Part I: 30 year Mortgage

Monthly Payment: Calculate the monthly payment for a 30 year loan (rounding up to the nearest cent) by using the following formula. Show your work. [PMT is the monthly loan payment, *P* is the mortgage amount, *r* is the annual percent rate for the loan *in decimal*, and *Y* is the number of years to pay off the loan. For the 30 year loan use an annual interest rate of 4.975%.

$$PMT = \frac{P\left(\frac{r}{12}\right)}{1-\left(1+\frac{r}{12}\right)^{-12Y}}$$

$$\frac{178{,}650\left(\frac{0.04975}{12}\right)}{1-\left(1+\frac{0.04975}{12}\right)^{-12(30)}} = \frac{178{,}650\,(.0041458333)}{1-(1.0041458333)^{-360}} = 956.30$$

Monthly Payment for a 30 year mortgage = $956.30

Note that this monthly payment covers only the interest and the principal on the loan. It **does not cover** any insurance or taxes on the property.

Amortization Schedule: In order to summarize all the information regarding the amortization of a loan, we construct a schedule that keeps track of the payment number, the principal paid, the interest, and the unpaid balance. A spreadsheet program is an excellent tool to develop an amortization schedule. We will use a free amortization spreadsheet at http://www.bretwhissel.net/amortization/amortize.html. Enter the **principal (amount of the loan)**, i.e. the selling price minus the down payment, the **annual interest rate**, and the appropriate **number payments per year** and **number of regular payments. Check the box** to show the amortization schedule.

Amortization Schedule monthly payment for a 30 year mortgage = $956.30
(Note: if this is more than 2 or 3 cents different from your calculation, check your numbers!)

Scroll down to find the **total interest paid** over 30 years = $165,621.41

and the **total amount repaid** = $344,271.41

Scroll down and look over the amortization schedule. Notice that the amount of the payment that goes towards the principal and the amount that goes towards the interest are not constant. What do you observe about each of these values over time?

interest ▷ the amount of intrest decreases and the principal

Principal ◁ increases over the years

Find the number of the first payment when more of the payment goes toward principal than interest. #194

As already mentioned, these payments are for principal and interest only. You will also have monthly payments for home insurance and property taxes. In addition, it is helpful to have money left over for those little luxuries like electricity, running water, and food. As a wise home owner, you decide that your monthly principal and interest payment should not exceed 35% of your monthly take-home pay. What minimum monthly take-home pay should you have in order to meet this goal? Show your work for making this calculation.

X = take home pay

$$\frac{.35x}{.35} = \frac{956.30}{.35} \quad X = 2732.29$$

Minimum monthly take home pay = $2732.29.

It is also important to note that your net or take-home pay (after taxes) is less than your gross pay (before taxes). Assuming that your net pay is 73% of your gross pay, what minimum gross annual salary will you need to make to have the monthly net salary stated above? Show your work for making this calculation.

$$\frac{2732.29}{.73} = 3742.86$$

Minimum gross monthly salary = $3742.86

Minimum gross annual salary = $44914.36

$3742.86 \times 12 = 44914.36$

Part II: Selling the House

Let's suppose that after living in the house for 10 years, you want to sell. The economy experiences ups and downs, but in general the value of real estate increases over time. To calculate the value of an investment such as real estate, we use continuously compounded interest.

Find the value of the home 10 years after purchase assuming a continuous interest rate of 4%. Use the full purchase price as the principal. Show your work.

$A = Pe^{rt}$

$A = 198500e^{.04(10)} = \$296127.20$

We will assume that you can sell the house for this amount. Determine the following information in order to calculate your gains or losses:

Selling price of your house $296127.20

Original down payment 19,850

Mortgage paid over the ten years = (see amortization schedule) interest paid 81314.55 + principal paid 33441.45 = 114756

The principal balance on your loan after ten years 145208.55

Use this information to determine if you have gained or lost money over the 10 years. Show your work here for determining the amount of your gain or loss.

296127.20 sell price
− 145208.55 amount left on loan
150918.65
− 19850.00 down payment
131068.65
− 114756 Mortgage paid for 10 years
16312.65 → gain $16312.65

Part III: 15 year Mortgage

Using the same purchase price and down payment, we will investigate a 15 year mortgage.

Monthly Payment: Calculate the monthly payment for a 15 year loan (rounding up to the nearest cent) by using the following formula. Show your work. [PMT is the monthly loan payment, *P* is the mortgage amount, *r* is the annual percent rate for the loan *in decimal*, and *Y* is the number of years to pay off the loan. For the 15 year loan use an annual interest rate of 4.735%.

$$PMT = \frac{P\left(\frac{r}{12}\right)}{1-\left(1+\frac{r}{12}\right)^{-12Y}}$$

$$\frac{178650\left(\frac{.04735}{12}\right)}{1-\left(1+\frac{.04735}{12}\right)^{-180}} = \frac{178650(.003945833)}{1-(1.003945833)^{-180}}$$

Monthly Payment for a 15 year mortgage = $1388.21

Use the amortization spreadsheet on the web again, this time entering the interest rate and number of payments for a 15 year loan.

Amortization Schedule monthly payment for a 15 year mortgage = $1388.21
(Note: if this is more than 2 or 3 cents different from your calculation, check your numbers!)

Total interest paid over 15 years = $71228.58

Total amount repaid = $249878.58 = 178650 + 71228.58

Find the number of the first payment when more of the payment goes toward principal than interest. #5

Compare the total interest paid for the 15-year mortgage verses the total interest paid for the 30 year mortgage – what is the difference?

15 year = 249,878.58
30 year = 344,271.41
difference of $94,392.83

Use the online amortization schedule to explore the effect of paying an additional amount towards the principal each month. To make the extra payment, include it in the monthly payment and leave the number of payments box blank.

For the 15- year mortgage, suppose you paid an additional $100 towards the principal each month. How long would it take to pay off the loan with this additional payment? 163 months
17 months earlier 15y − 17 months = 163m
What is the total amount of interest paid over the life of the loan? $63,899.69

Compare this total amount repaid to the total amount repaid without any extra payments. How much more or less would you spend if you made the extra principal payments?

71228.58
−63899.69
$7328.89 you would save on interest

Part IV: Reflection

Did this project change the way you think about buying a home? Write one paragraph stating what ideas changed and why. If this project did not change the way you think, write how this project gave further evidence to support your existing opinion about buying a home. Be specific.

Interest is paid on barrowed money. The less time and less amount that you can have a loan for saves you money long term. Simply throwing $25-$50 at a loan each month will save you a lot of money on interest.

My dad has many loans for rental properties he has told me a lot - about this idea but I learned exactly what these numbers mean. I saw the proof with this project. Barrow as little as possible for as short amount of time as possible to save as much money as possible. Duh, this is how banks make money.

I also liked learning about the amout gaind from selling a house after 10 years. Many people sell a house after 3-5 years and loose money. at that point it is better to just rent.