

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 \$19,850

Mortgage Amount \$178,650

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%.

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

Monthly Payment for a 30 year mortgage \approx \$956
(rounded)

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 \approx \$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 = \$165,621.37

and the total amount repaid \approx \$344,271.37

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? Amount going to interest decreases why amount going to principal increases.

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. $0.35x=956.30$ $x\approx 2732.29$

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. $y(0.73)=2732.29$. $y= 3742.86$. $z=y*12$. $Z\approx 44914.32$

Minimum gross monthly salary = 3742.86

Minimum gross annual salary = 44914.32

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.

$A = pe^{rt}$ (Compound interest formula)

$$A = 198500 e^{0.04 \cdot 10}$$

$$A \approx \$296127.20$$

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 $\approx \$296,127.20$

Original down payment $\$19,850$

Mortgage paid over the ten years = interest paid + principal paid
(see amortization schedule) $\$33,441.45$ + $\$81,314.55$ =
 $\$114,756.00$

The principal balance on your loan after ten years $\$145,208.55$

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. To answer this question we have to determine how we quantify loss.

In pure equity (current total assets vs current total liabilities) terms you come out ahead. Selling price- current mortgage principal debt (assuming you paid all the principal after selling the home to avoid accruing anymore interest.)

$$x = 296127.2 - 145208.55$$

$$x \approx 150918.65$$

If we go simply by total money input vs output over time it is a bit of a different story. We take the current balance left on the principal of the mortgage + the amount already paid + the original down payment. You get something like this

$$\$296,127.2 - 114,756 - 145,208.55 - 19,850 = y$$

$y = 16,312.65$ in perceived gains. Assuming you calculate for inflation, taxes paid over the years, things like retailer fees for selling the house, loss in spending power, other investments that could have been made with the money over the years, etc. If any amount is truly gained it is negligible.

So really it depends on how you measure your losses and gains. If you rented for instance your input output would likely be a different story, but you would not have built up any equity over the ten year period.

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%**.

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

Monthly Payment for a 15 year mortgage \approx \$1388

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 = 71,228.86

Total amount repaid = \$249,878.86

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

Compare the total interest paid for the 15-year mortgage versus the total interest paid for the 30 year mortgage – what is the difference? $\$165,621.36 - \$71,228.86 = x$ $x = \$94,392.5$

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
or \approx 13.6 Years

What is the total amount of interest paid over the life of the loan? \approx \$63,906.93

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?

$$\$249,878.86 - \$242,557.8 = x$$

$$x \approx 7321.06$$

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.

Yes and no. Anyone who has a credit card knows that interest quickly adds up and that you should pay off debts off as soon as you possibly can. So I figured it would be the same for large lone such as a home. None the less though it was good to see the numbers and they were fairly close to actual numbers which bizarrely is kind of odd for a math class. (I wish my bank paid the same interest as some of the ones in those math problems do, I would be rolling in the dough.)

One thing that very much did not change my mind, and seems to be a fallacy that many people still cling to is the idea of a home for investment purposes. For this assignment I suppose it is fine but the simple fact of the matter is that thinking housing (or any other investment for that matter) is “only going up” can lead to issues for potential buyers. That kind of speculation creates problems that can be seen as recently as the housing bubble that burst in about 2008. The average home price adjusted for inflation only increased approx. 0.4% from 1890 to 2004. So for about 114 years the increasing prices of homes remained fairly straight forward and fairly low. (Robert Shiller’s data) So really to assume that a home is a good finical investment is a bit of a logic flaw.