

Mortgage Loans

SUBMITTED BY: Nina Hoe, University of Pennsylvania

SUBJECT(S): Computation

GRADE LEVEL(S): 9, 10, 11, 12

≡ OVERVIEW:

This is a two-part/two-day lesson. Each lesson should take approximately 40-45 minutes. The majority of the first lesson is spent getting familiar with the idea of loans and terms associated with mortgages. This lesson begins with students discussing loans, and then specifically mortgage loans. Students calculate monthly payments for 30- and 15- year mortgages and then calculate the first year worth of individual payments. Students finish by examining a graph of the relationship between interest and principal payments monthly.

≡ RELATED ARTICLES:

- [“The Fed Revealed: The Dangers of Monetary Policy”](#)
- [“Olivia Mitchell on Why Young Consumers Should Just Say No to Spending”](#)

Standards:

NBEA Standard(s):

- Mathematical Foundations
- Number Relationships
- Patterns, Functions, and Algebra
- Problem Solving

Common Core Standard(s):

A-SSE.1. Interpret expressions that represent a quantity in terms of its context

A-CED.1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*

Objectives/Purposes: Students will understand the compounding of interest and mortgage loans.

Knowledge@Wharton Articles:

[“More Savings, Less Plastic: Consumer Credit after the Crisis”](#)

Other Resources/Materials:

- Calculators
- Accompanying Excel Spreadsheet showing example mortgage schedule

Day 1

Whole Class Discussion:

Loans (15 mins)

Orient students to the idea of borrowing money, loans, and why people do these things.

1. Do you always have enough money to buy what you want to buy?
2. What do you do if want to make a purchase for something you do not have enough money for?
3. What are some examples of things that you, or any consumer, might want to buy and might not have enough money to buy outright?
4. How do people get access to money?
5. What is a loan?
6. What does it mean to loan someone money or to be a lender?
7. What does it mean to receive money from a lender or to be a borrower?
8. What are the incentives for banks or other entities to lend money to borrowers? (i.e. is this ever done for free?)

Use student definitions of a loan to articulate a succinct definition from which students can work.

Example: A **loan** is a type of debt, typically a sum of money that is borrowed and is expected to be paid back (in most cases) with **interest**. A loan involves a lender, who provides the money, and the borrower, who uses the money and then pays it back to the lender over a specified **term** or period of time. The initial amount of loaned from the lender to the borrower is the **principal**.

Banks or other entities DO NOT usually lend money for free. They charge **interest** on **loans**, which is how they generate **revenue**, or income. However, different types of loans are structured in different ways with different interest rates and payment plans. Generally, there are two types of loans – **secured** and **unsecured**. **Secured loans** mean that there is some sort of security for the lender, or collateral, in case the borrower does not pay the loan back. Examples of this are home loans or car loans, whereby if the borrower **defaults**, or fails to make appropriate payments, the lender could take the home or car and resell it to recover the money lent. There are also **unsecured loans**, where there is no collateral for the lender, so if the borrower fails to pay the loan or declares bankruptcy, then the lender may lose the money all together. Examples of this are credit card loans or personal loans. Generally, interest rates are higher for unsecured loans and lower for secured loans. Additionally, the **term**, or amount of time, the borrower will take to pay back the loan has an effect on the interest rate. Generally, *shorter term* loans will have *lower interest rates* than loans with *longer terms*. Also, a person's **credit rating**, may determine the interest rate s/he gets. A **credit rating** is an estimate of the ability of a person or organization to fulfill their financial commitments, based on previous dealings (i.e. do you have a history of not paying back loans?).

Mortgage Loans (15 mins)

1. What is a mortgage loan?

Play the WGYG Glossary: [Mortgage Loan](#)

“A mortgage loan is a loan used to buy a home. The home is a security for the loan, and acts as a guarantee that the loan will be repaid. Sally recently took out a mortgage loan of \$200,000 to purchase her first home.”

2. Does buying a home usually involve a mortgage loan or not? (Do most people borrow or pay outright for a home?) (**Most people take a mortgage out to buy a home.**)

Break students into small groups to discuss the following questions.

3. Is a mortgage loan secured or unsecured? (**Secured – the house is the collateral.**)
4. How do you think mortgage interest rates compare to interest rates on a personal loan or credit card loan? Are they higher or lower?
5. What is the typical term for a mortgage loan? (**30 years, sometimes 15 years**)
6. Do you think the interest rates will be higher or lower for a 30-year vs. a 15-year mortgage? Why?

7. Do you know anyone who has a mortgage?
8. What is a **down payment**?

A **down payment** is the initial payment made when something is bought on credit – usually something expensive such as a car or home. This upfront portion of the cost is usually paid in cash after finalizing the transaction. For homes, down payments typically range from 3.5% – 30%, however 20% is usually advised. The more you put down on your home, the less you have to borrow and the less interest you will end up paying to the lender. In the housing crisis, many people bought homes with “no money down,” which became very problematic for various reasons.

There are two types of mortgages – **fixed rate** and **adjustable rate** mortgages. **Fixed-rate** mortgages have a set/predetermined interest rate for the entire term of the mortgage, while **adjustable-rate mortgages (ARM)** may readjust every month, 6 months, or year depending on a market driven index. They help transfer part of the interest rate risk from the lender to the borrower in case national interest rates increase dramatically or there are any other large economic changes within the 30-year term.

Generally, mortgage interest rates set by the market are typically lower than personal, unsecured loans, as the bank or lending party can use the home as collateral in case you default on your loan. That means that if you fail to make payments, your house may go into **foreclosure**.

9. What is **foreclosure**? When does this happen? Have you ever hear of a house going into foreclosure?

Play the WGYG Glossary: [Foreclosure](#)

“The legal process by which a borrower who can’t pay back a mortgage is deprived of his or her interest in the mortgaged property. This usually involves a forced sale of the property at public auction, with the proceeds of the sale being applied to the mortgage debt. Because Sally has been unable to make the monthly payments on the mortgage loan, her home has been placed in foreclosure.”

Small Group/Pair Activity: (total 60 mins – split over 2 days. The first day will probably include 20 mins max of reviewing formulas and relevant variables, problems 1 – 6. The second day should begin with 7.)

Although students should work in small groups or pairs, it may be helpful to start this exercise with students to get comfortable with the calculations first. Make sure that students have the correct answers to questions 3, 4, and 5a before they move on to question 7 in small groups/pairs.

Recall the formula for **simple interest**

$$I = P * r * t$$

where,

- I is the interest owed
- P is the principal amount outstanding
- r is the interest rate
- t is the time in years.

Note: to express 1 month in terms of years, divide by 12, so that to calculate the interest over a period of 1 month, $t = 1/12$

Recall the general form for **compound interest** (an **exponential growth model**) is the equation:

$$A = P \left(1 + \frac{r}{n}\right)^{nt}$$

where, P is the principal amount, or the original amount of money before any growth occurs

- r is the annual nominal interest rate or the **growth rate** in decimal form
- n is the number of times the interest is compounded per year
- t is the number of years, and A is the new amount.

Formula for Interest Compounded Monthly:

$$A = P\left(1 + \frac{r}{12}\right)^{12t}$$

1. What are median or average home prices in your area? **(Students may shout out actual numbers, or you can Google this – note: the median home price in the US as of April 2011 was \$217,900. Adjust for your demographic accordingly.)**
2. What seems like a reasonable price to pay per month for a mortgage payment?

The formula for calculating mortgage payments:

$$MP = P * \frac{\frac{r}{n} \left(1 + \frac{r}{n}\right)^{nt}}{\left(1 + \frac{r}{n}\right)^{nt} - 1}$$

where, MP is the monthly payment

- P is the principal amount, or the loan amount
- r is the annual nominal interest rate or the **growth rate** in decimal form
- n is the number of times the interest is compounded per year
- t is the number of years

This is a very complicated formula, but has a lot of similar components to the compound interest formula. It is more complicated because each month, as you make payments, the proportion of the monthly payment that goes towards interest vs. principal changes.

1. What would a 20% down payment be on this reasonably priced home your class established in problem 1?
2. How much would you need to borrow?
3. Based on the amount that you need to borrow,
 1. Calculate the monthly payment for a 30-year mortgage on the reasonable home price your class decided upon in question 1 with an interest rate of 5%. Define all of your variables.
 2. How much will you pay in total for the amount that you borrowed?
 3. Express your answer to b as percentage of the total amount borrowed.
 4. Based on the amount that you need to borrow,
 1. Calculate the monthly payment for a 15-year mortgage on the reasonable home price your class decided upon in question 1 with an interest rate of 3.6%. Define all of your variables.
 2. How much will you pay in total for the amount that you borrowed?

3. Express your answer to b as percentage of the total amount borrowed.

Day 2

1. Begin to fill in the chart below to see what happens to your monthly payment (of \$_____) during the first year of your 30-year mortgage with an interest rate of 5% compounded monthly. Make sure you are using the correct number from 5a.

Loan Amount = \$_____

Interest Rate = 5%

Monthly Payment = \$_____

Month	Balance (P)	Payment	Interest on Balance	Principal
1	1^{st} : <i>Original Balance/Loan Amount</i> <i>(Answer to #4)</i>	<i>(Answer to 5a)</i>	2^{nd} :	3^{rd} : <i>Payment (5a) – Interest (I)</i>
2	4^{th} : <i>Previous Balance – Principal</i>	<i>(Answer to 5a)</i>	5^{th} : <i>$I = (\text{new } P \text{ from this row}) * r * t$</i>	6^{th} : <i>Payment (5a) – I (this row)</i>
3		<i>(Answer to 5a)</i>		

This sequence of calculations shows that for the first month, you owe the 5% interest on the original amount borrowed. However, you are only paying a certain amount in payment each month. In the beginning, the majority of the monthly payment goes towards the interest and only a small portion goes towards the principal. Each month, while the monthly payment stays the

same, the interest is calculated based upon the new balance (in the same row). The new principal is calculated by subtracting the appropriate interest payment from the monthly payment.

Month	Balance	Payment	Interest on Balance	Principal
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
Total	—			

1. What is your current balance?
2. How much have you paid in interest so far?
3. How much of your total amount borrowed have you paid off after 1 year (the total principal)?
4. What percentage of your original balance do you have left?
5. How would paying more than your monthly payment affect your mortgage schedule and interest owed each month?

Look at the graph below. It shows, for a 30-year mortgage on \$80,000 at 5% interest, the relationship between the percentage of the monthly mortgage payment going towards interest and principal. The payment amount is on the y-axis and the number of months are shown on the x-axis. The purple line shows the interest payment while the pink line shows the principal payment.

1. For which years in a 30-year (360 months) do the monthly payments go primarily towards interest?
2. At what stage in during the 30-years (360 months) do the monthly payments go equally towards interest and principal?
3. For which years in 30-years (360 months) do the monthly payments go primarily towards the principal?
4. Does this surprise you?

Extending the Activity

Have students compute any other mortgage loan payment and schedule. Identify a home price, calculate the down payment, define an interest rate, and choose the term. Have students compare this to the one they calculated for this activity.

Tying It All Together:

[Student Worksheet](#)

Whole Class Discussion

1. If you were going to explain the process of a mortgage loan to someone else, what would you want to make sure to cover? What are the important elements?
2. Why do you think many people do not understand this process?
3. Who takes a mortgage loan?
4. Why are the rates lower than a credit card loan?
5. What are ways to decrease the amount of interest you pay?
6. How are 15- and 30-year mortgages related to one another?
7. Because you end up paying so much in interest, is it still worth buying a house?
8. Why do people do this instead of rent?

Practice Outside of the Classroom:

Explain this concept to friends and family members. Who does not understand these concepts!
(Probably most people)

What Worked and What I Would Do Differently:

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