

## Finance 4713: Mortgage Amortization

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For the following interest rates and payment amounts, compute the loan amortization. The note requires a minimum payment of \$1800 per month, but the borrower is allowed to pay additional if desired. The note rate (APR) may change each month.

Date	Payment	APR	Int Due ( $\frac{APR}{1200} \times \text{Bal}_{t-1}$ )	Principal Paid ( $\text{PMT} - \text{Int}$ )	Balance ( $\text{Bal}_{t-1} - \text{Prin}_t$ )
Jan 1	0				250,000.00
Feb 1	1800.00	7.000%			
Mar 1	2000.00	7.500%			
Apr 1	1800.00	9.375%			
May 1	1900.00	7.125%			

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Unless stated otherwise, assume mortgage payments are made monthly.

1. Complete the following table, assuming monthly payments.

Interest Rate	Loan Amount	Term (years)	Monthly Payment	Yr 1 Interest Amount	Year 1 Principal	Balance after 1 Year.
14%	180000	30				
7%	180000	30				
3%	180000	30				
14%	180000	15				
7%	180000	15				
3%	180000	15				

2. How much interest will you pay in the 14th year of a \$105,000, 5.5%, 20-year mortgage?

3. How much will you pay into principal on a  $7\frac{5}{8}\%$ , \$155,000, 15 year mortgage in the final 3 years of the mortgage.

4. Compute the balance, at  $13 \frac{3}{4}$  years, on a \$125,000, 6.75%, 20 year mortgage.

5. You need a loan of \$175,000, but want to pay it off as soon as possible. For a 7.25% rate, and 30 year term, what will your required monthly payment be? If you choose to pay \$1675 per month on this loan, how fast will you be able to pay if off?

6. With a graduated payment mortgage, your initial payments are too low to amortize your loan at the standard rate. If a 155,000 mortgage with a 8% interest rate is chosen, and the first year payment is \$800/mo., what will the balance be after the first year? How much will you have paid into interest in the first year?

7. You have acquired a \$155,000 mortgage at 6.125%, for 30 years. If you make a quadruple payment on the first anniversary of the mortgage, and then make the required payments from then on, how many fewer mortgage payments will you make than if you just paid your required amount for the life of the loan.

8. A reset mortgage allows for one interest rate reset during the life of the loan. If you have a 3/17, the mortgage rate will be reset after 3 years, to fully amortize at the end of the original 20 year period (i.e. after 17 more years). For a  $6\frac{3}{8}\%$ , \$150,000, mortgage, compute the reset payment if the new rate resets to  $8\frac{5}{8}\%$ .

Example 1: How many points must a lender charge for a 6 percent, 15-year note to achieve a yield of 6.5%? (Though the loan amount does not matter, assume a \$100,000 loan for computations)

- A. Assume the borrower holds the note for the entire term

Example 1: How many points must a lender charge for a 6 percent, 15-year note to achieve a yield of 6.5%? (Though the loan amount does not matter, assume a \$100,000 loan for computations)

- B. Assume the borrower holds the note for 3-years

Example 2: Short term bullet loan with points. You are offered a bullet loan at Prime plus 3 for 6 months, with 3 points. Prime is currently at 4% and we will assume it will remain stable. What is your expected financing cost expressed as an EAR assuming you make monthly interest only payments and you draw the entire line at the start of the loan?



Example 3: To buy your dream home you use a 3/12 reset loan that pays interest only (bullet loan) for the first 3 years, followed with a reset payment to amortize over the remaining 12 years. The loan amount is \$180,000 at 6.5%, with 3 discount points (to the lender) and \$950 in third party closing costs which the borrower must pay.

- a) What net amount does the lender disburse?
- b) What net amount do you as a borrower receive?
- c) What is your monthly payment during the first 3 years?
- d) What is your monthly payment during the remaining 12 years?
- e) What is the FTLAPR on this loan?
- f) What is your balance after 4 years?
- g) If you repay this loan after 4 years, what is the effective yield for the lender?
- h) If you repay this loan after 4 years, what is the effective cost to you, the borrower?

**Example 4: ARM Example 1.** You are seeking a loan for your \$250,000 house and have determined that you would like to choose an ARM because you expect to keep the house for just 3 years. Assume you make a 20% down payment and pay 3 points. You will also incur \$1350 in third party closing costs. What are your CF's, the yield to lender and cost to borrower? What do you pay each year in interest?

- Initial rate 3.25%
- Annual adjustments – Tbill + 2.25% (rounded to 1/8%)
- No payment or interest rate caps
- Index, now at 4.21, then changes annually to: 3.67, 6.23, 8.33

**Example 5: ARM Example 2.** You are seeking a loan for your \$250,000 house and have determined that you would like to choose an ARM because you expect to keep the house for just 3 years. Assume you make a 20% down payment and pay 2 points. What are your CF's and the yield to lender? What do you pay each year in interest?

- Initial rate 3.5%
- Annual adjustments – Tbill + 2.75% (rounded to 1/8%)
- Max change of 2% per year interest rate
- Max interest of 5% above initial rate
- Index, now at 4.21, then changes annually to: 3.67, 6.23, 8.33

**Example 6: ARM Example 3.** You are seeking a loan for your \$250,000 house and have determined that you would like to choose an ARM because you expect to keep the house for just 3 years. Assume you make a 20% down payment and pay 1 point. What are your CF's and the yield to lender? What do you pay each year in interest?

- Initial rate 3.75%
- Annual adjustments – Tbill + 2.75% (rounded to 1/8%)
- Max payment change of 7.5% per year (negative amortization allowed)
- Max interest of rate 6% above initial rate
- Index, now at 4.21, then changes annually to: 3.67, 6.23, 8.33

### **Example 6a: Interest Paid during 12 month period**

The lowest prior balance on your fixed rate 6% note was \$94,000.

The current balance, including accrued interest is \$96,000 (i.e. there is \$2000 of accrued interest currently due on this loan). What amount will you pay in interest over the next 12 months if:

- a) Payment is \$450 per month
- b) Payment is \$550 per month
- c) Payment is \$750 per month

**Example 7: FTLAPR for ARM.** A 15-year ARM with 3 points (\$100,000 note amount) is offered with an initial interest rate of 3% based on the 1 year Treasury Index that is currently at 5.82. The margin is 275 bp, and the composite rate will be rounded to the closest 1/8%. Annual interest rate cap is 2%, with a 6% lifetime ceiling (increase). What is the FTLAPR?

**Example 8: PLAM** Consider a \$100,000 loan offered at a 3% real rate of interest over 20 years. Payments and loan balance will be adjusted annually. Assuming inflation over the next three years is 18%, 11%, and 15% respectively, what are the loan payments, and final payoff required at the end of year 3?

**Example 9: SAM** You have a building currently valued at \$1,200,000 for which you seek a \$1,000,000 mortgage (30-year term with 5 year balloon). You are offered a SAM at 5%, where you must also give the lender 45% of the appreciation after 5 years. For an 8% annual inflation rate for the building, and assuming you hold the building for 5 years, what are your cash flows on the loan. What is the yield to the lender?



**Example 10: Refinance 1:** You currently have an 8%, 30-year loan you took out 2 years ago. You can refinance this at 6.5% with 3 points in fees to a new 28 year loan. You expect to keep this new loan for 2 years. Your original note was for \$80,000 and you will take the closing costs from your savings account that is currently paying 5%. Is this a good choice?

**Example 11: Refinance 2** : You currently have an 8%, 30-year loan you took out 2 years ago. You can refinance this at 6.5% with 3 points in fees to a new 30-year loan. You expect to keep this new loan for 2 years. Your original note was for \$80,000 and you will add the closing costs to your existing loan balance. Is this a good choice?

**Example 12: Market Value of Existing Loan** : You took out a 9%, 30-year mortgage for \$160,000, four years ago. Current rates are 6.5%. What is the market value of this loan if:

You keep the loan until maturity

You payoff the loan 4 years from now

What if the current market rate is 10%?

**Example 13: Builder Buydown** : To move inventory a builder is offering either a mortgage at 6% when rates are 6.5%, or a 2/1 buy down (2% lower interest rate the first year followed by a 1% buy down the second year. What are the values of these alternative financing alternatives (160,000 note amount) assuming you will keep the loan for a) 3 years, or b) 8 years?

**Example 14: Value of Assumability:** Five years ago you purchased a new home for 100,000 (with a 20% down payment). You now have an offer in hand from a buyer for \$150,00, subject to the buyer assuming your 5.5% loan. The buyer can get a 25-year second mortgage at 7.5% as long as he puts 20% equity into the deal. New 80%-LTV, 25-year mortgages are available at 6.5%. What is the apparent value of the note assumability (assume a 7 year horizon for the purchaser).

Solution to Example 14. As usual, first we compute the payment, in this case starting with the PMT on the original note.

P/YR=12

$PMT(PV=-80000, N=360, I/YR=5.5) = 454.23$

Compute Bal month 60 (today) and month 144 (7 years from now) for use later

1 INPUT 60 ■ AMORT Bal60 = 73,968.57

1 INPUT 144 ■ AMORT Bal144 = 62,196.82

Buyer needs \$120,000 financing for 80% LTV

$120000 - 73968.57$  (assume) = 46031.43 needed as a second mortgage.

PMT on 2<sup>nd</sup> mortgage

$PMT(PV=-46031.43, N=300, I/YR=7.5) = 340.17$

Compute balance after 7 years when you repay

1 INPUT 84 ■ AMORT Bal84 = 40257.65

Total Pmt of assumed plus 2<sup>nd</sup> :

$454.23 + 340.17 = 794.40$

Total Balance owed after 7 years:

$62196.82 + 40257.65 = 102454.47$

Or: Take out a new 1<sup>st</sup> mortgage for 120000 (25 yr)

$PMT(PV=-120000, I/YR=6.5, N=300)=810.25$

1 INPUT 84 ■ AMORT Bal84 = 103011.36

$PMT = 810.25 - 794.40 = 15.85$

$BAL = 103011.36 - 102454.47 = 556.89$

Value of the assumption is the present value of savings

$PV(PMT=15.85, FV=556.89, N=84, I/YR=6.5) = 1421.13$

Example 15: A customer is offered a 6.75%, 30 yr FRM loan for \$160000 ( 80% LTV) with 3 points and no other financing fees. This loan will close on the first of the month.

- What is the FTLAPR?
- What is the Finance Charge?
- What is the Amount Financed?
- What is the Total of Payments?

Example 16: PMI will automatically be cancelled when the loan is 78% of the original purchase price

For a 30 year 7.75% loan with \$10,000 down for a \$200,000 house, in what month will the PMI be cancelled?



**Fin4713: Example: How much house can I afford?**  
**(Fixed amount for Property Tax and Insurance, traditional qualifying ratios)**

You have a \$50,000 annual income, and make car payments of 450 per month but have no other debt, and have \$30000 in the bank. How much house can you afford, given the following mortgage opportunity?

FRM conventional 30 year at 7.875%, requires 20% down with 28/36 (frontend/backend) qualifying ratio. Two discount points will be charges and closing cost and pro-rates = \$3000. Property taxes will be 3600 per year and insurance 360 per year.

**Step 1. How much of loan do I qualify for? This depends on the PITI I am allowed**

	<u>28%</u>	<u>36%</u>
Monthly income*ratio (50000/12*ratio)	1166.67	1500
Less other debts		<u>450</u>
Choose Min. as available for PITI	1166.67	1050

Available for PITI =	1050
Less property taxes	- 300
Less insurance	<u>- 30</u>
Available for debt service (PI)	720

Max amount of loan you can service (use financial calculator or formula):

$$PV(N=360, I/YR=7.875, PMT=720) = \$99,300.84$$

**Step 2: Compute maximum size of loan you can afford to close on.**

Savings =	30000
Other closing	<u>3000</u>
Funds available for points and down payment.	27000

Define the following notation: HV = house value    LV = loan value

For a 20% down payment loan note that  $0.8*HV=LV$  or we can rewrite as

$$HV = 1.25*LV$$

In general for a down payment percent of "d" we can write  $(1-d)*HV = LV$ , or

$$HV = [1/(1-d)]*LV$$

We will allocate our available cash to either the down payment or the points so we can write:

$$\text{Cash} = \text{Down payment} + \text{loan point fee}$$

We know the Down payment depends on the HV and loan point fee on fee on the LV so we write:

$$\text{Cash} = d*HV + p*LV \quad \text{where } p = \text{points, expressed as a fraction of loan}$$

We know the amount of cash we have, d, & p. We also know that  $HV=[1/(1-d)]*LV$  so we can write

$$\text{Cash} = d*[1/(1-d)]*LV + p*LV$$

or, solving for what we want to know, the LV we have:

$$LV = \text{Cash} / [(d/(1-d) + p)]$$

For  $d=0.2$  (i.e. 20% down payment) and  $p=0.02$  (i.e. 2 points) and  $\text{cash}=27000$  we have:

$$LV = 27000 / [.2/(1-.2) + .02] = 27000 / .27 = 100000$$

This is maximum size loan that we have funds to close on.

We need to choose the lower of the two possible loan amounts; thus, the maximum size loan we can afford is \$99,300. What is the maximum house we can afford? (Note that we don't need all of our cash to close this smaller loan, so we can use the extra money for a higher down payment (i.e. we are allowed more than 20% down, we are just not allowed less) so we can apply that to buying the house. What remains is to compute the amount of house.

$$\begin{aligned} \text{Max house} &= \text{Loan amount} + \text{cash} - \text{prepays} - \text{points} = \\ &= 99300.84 + 30000 - 3000 - 1986.02 = \$124,314.82 \end{aligned}$$

This problem, is somewhat simplified because we assume the property taxes and insurance are fixed. In reality, these values depend on the value of the house, so as we spend more on the house, we increase the increase the TI part of the equation, so we need to reduce the PI, which reduces the loan amount, which reduces the value of the house we can afford. To solve with all variables, truly variable, becomes a trial and error solution (you could use a goal seeking approach in Excel).