

11.5 Buying a House with a Mortgage

Mathematical Concepts

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Homeowner's Mortgage: A long-term loan in which the property is pledged as security for payments of the difference between the down payment and the sale price.

The two most popular types of mortgage loans are :

- ▶ *the conventional loan*: interest rate is fixed for the duration of the loan
- ▶ *the adjustable-rate loan (or variable-rate loan)*: interest rate may change every period, as specified in the loan.

Remarks:

The size of the down payment required depends on:

- ▶ who is lending the money
- ▶ how old the property is
- ▶ whether or not it is easy to borrow money at that particular time.

The down payment required by the lending institution can vary from 5% to 50% of the purchase price.
Most lending institutions tend to require larger down payments on older homes and smaller down payments on newer homes.

Lending institutions may require the buyer to pay one or more **points** for a loan at the time of the **closing**.

points: interest prepaid by the buyer and may be used to reduce the stated interest rate the lender charges.

- ▶ One point is equal to 1% of the loan amount.
- ▶ reduction in interest rate allows the lender to reduce the size of the monthly mortgage payment.
- ▶ since points are considered interest, the rate of interest that lenders state when you are applying for a mortgage is not the APR for the loan.

Example 1

a) down payment is 15% of \$249,000
 $0.15 \times \$249,000 = \boxed{\$37,350}$

b) Mortgage = (Selling price) - (down payment)
 $= \$249,000 - \$37,350$
 $= \boxed{\$211,650}$

Patricia and Marshall Martin wish to purchase a house selling for \$249,000. They plan to obtain a loan from their bank. The bank requires a 15% down payment, payable to the seller, and a payment of 2 points, payable to the bank, at the time of closing.

- Determine the Martins' down payment.
- Determine the amount of the Martins' mortgage.
- Determine the cost of the 2 points paid by the Martins' on their mortgage.

c) Each point is 1% of mortgage amt.
So 2 points is
 $0.02 \times \$211,650$
 $= \boxed{\$4,233}$

Banks use a formula to determine the maximum monthly payment that they believe is within the purchaser's ability to pay.

- ▶ the buyer's **adjusted monthly income** is determined

$$\left(\begin{array}{c} \text{gross monthly} \\ \text{income} \end{array} \right) \text{ minus } \left(\begin{array}{c} \text{fixed monthly payments} \\ \text{with more than} \\ \text{10 months remaining} \end{array} \right)$$

Fixed monthly payments include student, car, furniture or television loans.

- ▶ the adjusted monthly income is then multiplied by 28%
 - ▶ the lending institution believes this product is the *maximum monthly house payment* the purchaser can afford to pay.
 - ▶ this payment must cover *principal, interest, property taxes, and insurance*

the percent and the maximum number of payments remaining on other fixed loans, may vary in different locations.

Example 2

Suppose the Martins' (see previous example) gross monthly income is \$7250 and they have 23 remaining monthly payments of \$225 on their car loan, 17 remaining monthly payments of \$175 on their daughter's orthodontic braces, and 11 remaining monthly payments of \$45 on a loan used to purchase new furniture. The property taxes and homeowners' insurance on the house they wish to buy are \$165 and \$115 per month, respectively. Their bank will approve a loan that has a total monthly mortgage payment of principal, interest, property taxes, and homeowners' insurance that is less than or equal to 28% of their adjusted monthly income.

$$\begin{aligned} \text{a) Monthly payments} &= \$225 + \$175 + \$45 \\ &= \$445 \end{aligned}$$

$$\text{adjusted monthly} = \text{gross} - \text{monthly payments}$$

$$= \$7250 - 445$$

$$= \$6805$$

$$28\% \text{ of adjusted monthly income}$$

$$= 0.28 \times \$6805$$

$$= \boxed{\$1905.40}$$

a) Determine 28% of the Martins' adjusted monthly income.

b) The Martins' want a 30-year, \$211,650 mortgage. If the interest rate is 7.0%, determine the total monthly mortgage payment (including principal, interest, property taxes, and homeowners' insurance) for this mortgage.

c) Determine whether the Martins qualify for this mortgage.

b) From table monthly principal and interest payments per \$1000 of mortgage for rate 7.0% & 30-year mortgage is \$6.65.

So Martins monthly payment is

$$\frac{211,650}{1000} \times \$6.65 \approx \$1407.47$$

$$\begin{aligned} \text{Total monthly mortgage payment is} \\ \$1407.47 + \$165 + \$115 \\ \text{(taxes) (insurance)} \end{aligned}$$

$$= \$1687.47$$

c) Most likely because part b) is less than part a)

• Example 3

a) 30x12 monthly payments

Total principal + interest paid

$$= \$1407.47 \times 360$$

$$= \$506,689.20$$

$$\text{Total Cost} = 506,689.20 + 37,350.00 + 4233$$

$$= \boxed{\$548,272.20} \quad \begin{array}{l} \text{down} \\ \text{payment} \end{array} \quad \begin{array}{l} 2 \text{pts} \\ \end{array}$$

Patricia and Marshall Martin of Examples 1 and 2 purchased a house selling for \$249,000. They made a 15% down payment of \$37,350 and obtained a 30-year conventional mortgage for \$211,650 at 7.0%. They also paid 2 points at closing. Their monthly principal and interest payment on their mortgage is \$1407.47. Recall that points are considered as interest.

- Determine the total amount including principal, interest, down payment, and points the Martins will pay for their house over 30 years.
- How much of the cost in part (a) is interest?
- How much of the first mortgage payment is applied to the principal?

$$\begin{aligned} \text{b) Total interest} &= \text{Total Cost} - \text{purchase price} \\ &= \$548,272.20 - 249,000 \end{aligned}$$

$$\begin{aligned} \text{c) } i &= prt \\ &= \boxed{\$299,272.20} \\ &= \$211,650 \times 0.07 \times \frac{1}{12} \\ &= \$1234.65 \end{aligned}$$

$$\begin{aligned} \text{Principal} &= \left(\text{Monthly Payment} \right) - \left(\text{Interest Paid} \right) \\ &= \boxed{\$172.84} \\ &= \$1407.47 - 1234.63 \end{aligned}$$

The rules for adjustable-rate mortgages vary from state to state and from bank to bank.

Generally, the monthly mortgage payment remains the same for a 1-, 2-, or 5-year period even though the interest rate of the mortgage may change every 3 months, 6 months, or some other predetermined period.

The interest rate may be based on an index that is determined by the Federal Home Loan Bank Association or on the interest rate of a 3-month, 6-month, or 1-year Treasury bill.

The interest rate of a 3-month Treasury bill may change every 3-months, the interest rate on a 6-month Treasury bill may change every 6 months and so on.

When the base is a Treasury bill, the actual interest rate charged for the mortgage is often determined by adding 3% to $3\frac{1}{2}\%$, called the **add on rate** or **margin**, to the rate of the Treasury bill.

Thus, if the rate of the Treasury bill is 6% and the add on rate is 3%, the interest rate charged is 9%.

Tony and Keisha Torrence purchased a house for \$115,000 with a down payment of \$23,100. They obtained a 30-year adjustable-rate mortgage with the following terms. The interest rate is based on a 6-month Treasury bill. The interest rate charged is 3% above the the interest rate of the 6-month Treasury bill (3% is the add on rate). The interest rate is adjusted every 6 months on the date of adjustment. The interest rate will not change more than 1% (up or down) when it is adjusted. The maximum interest rate for the duration of the loan is 12%. There is no lower limit on the interest rate. The initial mortgage interest rate is 5.5%, and the monthly payments (including principal and interest) are adjusted every 5 years.

$$\begin{aligned}
 \text{a) Mortgage} &= (\text{selling price}) - (\text{down payment}) \\
 &= \$115,000 - \$23,000 = \$91,900
 \end{aligned}$$

Monthly principal + interest payment per \$1000 with $r=5.5\%$ for 30 years is \$5.68 see tables
 So initial monthly payment is

$$\frac{91,900}{1000} \times \$5.68 \approx \boxed{\$521.99}$$

- Determine the initial monthly payment.
- Determine the adjusted interest rate in 6 months if the interest rate on the Treasury bill at that time is 2%.

$$\begin{aligned}
 \text{b) adjusted interest rate} &= (\text{Treasury bill rate}) - (\text{addon rate}) \\
 &= 2\% + 3\% \\
 &= 5\%
 \end{aligned}$$

Note: The rate after 6 months, 5%, is lower than the initial rate of 5.5%

Recall that the monthly payment remains the same. So the additional money paid the bank is applied to reduce the principal.

The monthly interest and principal payment of \$521.99 would pay off the loan in 30 years if the interest remained constant at 5.5%.

What happens if the interest rate drops and stays lower than the initial 5.5% for the length of the loan?

At the end of each 5 year period the bank reduces the monthly payment so that the loan will be paid off in 30 years.