

Section D.1: Loan Basics**Definition of loan principal**

For any loan, the *principal* is the amount of money owed at any particular time. Interest is charged on the loan principal. To pay off a loan, you must gradually pay down the principal. Thus, in general, every payment should include all the interest you owe plus some amount that goes toward paying off the principal.

Ex.1

Suppose you borrow \$1200 at an annual interest rate APR = 12% (or 1% per month). At the end of the first month, you owe interest in the amount of

If you paid only this \$12 in interest, you would still owe \$1200. That is, the loan principal would still be \$1200. In that case you would owe the same \$12 in interest the next month and this can go on forever.

If you hope to make progress in paying off the loan, you need to pay part of the principal as well as interest. For example, suppose that you paid \$200 toward your loan principal each month, plus the current interest. At the end of the first month, you would pay \$200 toward principal, plus \$12 for the 1% interest you owe:

Because you have paid \$200 toward principal, your new loan principal would be

At the end of the second month, you would again pay \$200 toward principal and 1% interest

The table shows how the calculations continue until the loan is paid after 6 months.

AFTER N MONTHS	PRIOR PRINCIPAL	INTEREST	TOTAL PAYMENT	NEW PRINCIPAL
1	\$1200	$1\% \times 1200 = 12$	$200 + 12 = 212$	\$1000
2	\$1000	$1\% \times 1000 = 10$	$200 + 10 = 210$	\$800
3	\$800	$1\% \times 800 = 8$	$200 + 8 = 208$	\$600
4	\$600	$1\% \times 600 = 6$	$200 + 6 = 206$	\$400
5	\$400	$1\% \times 400 = 4$	$200 + 4 = 204$	\$200
6	\$200	$1\% \times 200 = 2$	$200 + 2 = 202$	\$0

Installment loan and loan payment formula

There is nothing wrong with this method of paying off a loan, but most people prefer to pay the same total amount each month because it makes planning a budget easier. A loan that you pay off with equal regular payments is called *installment loan* (or amortized loan). The regular payment amount can be computed using the *loan payment formula*:

$$\text{PMT} = \frac{P \times \left(\frac{\text{APR}}{n} \right)}{\left[1 - \left(1 + \frac{\text{APR}}{n} \right)^{(-nY)} \right]}$$

where

PMT = regular payment amount

P = starting loan principal (amount borrowed)

APR = annual percentage rate (as a decimal)

n = number of payment periods per year

Y = loan term in years

Ex.2

What is the regular payment amount in Example 1?

Principal and interest payments.

Because the loan principal is gradually paid down with the installment payments, the interest due each month must also decline gradually. Thus, because the payments remain the same, the amount paid toward principal each month gradually rises. Therefore, the portions of installment loan payments going toward principal and toward interest vary as the loan is paid down. Early in the loan term, the portion going toward interest is relatively high and the portion going toward principal is relatively low. As the term proceeds, the portion going toward interest gradually decreases and the portion going toward principal gradually increases.

Ex.3 Student loan.

Suppose you have student loans totaling \$7500 when you graduate from college. The interest rate is APR = 9% and the term is 10 years. What are your monthly payments? How much will you pay over the lifetime of the loan? What is the total interest you will pay on the loan?

|| **Ex.4** Principal and interest payments.

|| For the loan in Example 3, calculate the portions of your payments that go to principal and to interest during the first 3 months.

Choices of rate and termChoices of rate and term.

You will usually have several choices of interest rate and loan term when seeking a loan. Thus, you will have to evaluate your choices and make the decision that is the best for your personal situation.

Ex.5

You need a \$6000 loan to buy a used car. Your bank offers a 3-year loan at 8%, a 4-year loan at 9%, and a 5-year loan at 10%. Calculate your monthly payments and total interest over the loan term with each option.

Section D.2: Credit CardsCredit card loans

Credit card loans differ from installment loans in that you are not required to pay off your balance in any set period of time. Instead, you are required to make only a minimum monthly payment that generally covers all the interest but very little principal. As a result, it takes a very long time to pay off your credit card loan in a particular amount of time. You should use the loan payment formula to calculate the necessary payments.

Ex.6

You have a credit card balance of \$2300 with an annual interest rate of 21%. You decide to pay off your balance in 1 year. How much will you need to pay each month? Assume you make no further credit card purchases.

Ex.7

Paul has gotten into credit card trouble. He has a balance of \$9500 and just lost his job. His credit card company allows him to suspend his payments until he finds a new job, but continues to charge interest. If it takes him a year to find a new job and his credit card company charges interest of $\text{APR} = 21\%$ compounded daily, how much will he owe when he starts his new job?

Section D.3: Mortgages**Mortgages**

One of the most popular types of installment loans is designed specifically to help you buy a home. It is called *mortgage*. Mortgage interest rates generally are lower than interest rates on other types of loans because your home itself serves as a payment guarantee. If you fail to make your payments, the lender (usually a bank or a mortgage company) can take possession of your home and sell it to cover the amount loaned to you.

There are several considerations in getting a home mortgage. First, the lender will probably require a *down payment*, typically 10% or 20% of the purchase price. Then the lender will loan you the rest of the money needed to purchase the home.

Most lenders also charge fees, or *closing costs*, at the time you take out the loan. Closing costs can be substantial and may vary significantly between lenders, so you should be sure that you understand them.

There are two types of closing costs:

- Direct fees, such as fees for getting the home appraised and checking your credit history, for which the lender charges a fixed dollar amount. These fees typically range from a few hundred dollars to a couple thousand dollars.
- Fees charged as *points*, where each point is 1% of the loan amount.

If you are seeking a home mortgage, be sure to keep the following considerations in mind as you compare lenders:

- What interest rate and down payment are required for the loan?
- What closing costs will be charged?
- Watch out for fine print, such as prepayment penalties, that may make the loan more expensive than it seems on the surface.

Ex.8

You need a loan of \$100,000 to buy your new home. The bank offers a choice of a 30-year loan at an APR of 8% or a 15-year loan at 7.5%. Compare your monthly payments and total loan cost under the two options. Assume that the closing costs are the same in both cases and therefore do not affect the choice.

Ex.9

Great Bank offers a 100,000, 30-year, 8% loan with closing costs of \$500 plus 2 points. Big Bank offers a lower rate of 7.9%, but with closing costs of \$1000 plus 2 points. Evaluate the two options.

Ex.10

Continuing Example 9, suppose you have decided to go with Great Bank's lower closing costs. You learn that Great Bank actually offers two options for a 30-year loan: an 8% interest rate with 2 points or a 7.5% rate with 4 points. Evaluate your options.

Adjustable Rate Mortgages**Fixed and adjustable rate mortgages**

Till now all examples had *fixed rate mortgage* in which you are guaranteed that the interest rate will not change over the life of the loan. A fixed rate mortgage is advantageous for you because your monthly payments never change. However, it poses a risk to the lender. Lenders can lessen the risk of rising interest rate by charging higher rates for longer-term loans. That is why rates generally are higher for 30-year loans than for 15-year loans. But an even lower-risk strategy for the lender is an *adjustable rate mortgage* (ARM) in which the interest rate you pay changes whenever prevailing rates change. Because of the reduced long-term risk to lenders, ARM generally have much lower initial interest rates than fixed interest rate loans. Most ARMs guarantee their starting interest rate for the first 6 months or 1 year, but interest rates in subsequent years move up or down to reflect prevailing rates. Most ARMs also include a rate cap that cannot be exceeded. Making a decision between a fixed rate loan and an ARM can be one of the most important financial decision of your life!!!

Ex.11

You have a choice between a 30-year fixed rate loan at 8% and an ARM with a first-year rate of 5%. Neglecting compounding and changes in principal, estimate your monthly savings with the ARM during the first year on a \$100,000 loan. Suppose that the ARM rate rises to 11% by the fourth year. How will your payments be affected?