Unit 2

Borrowing Money

Lessons 9 to 13 examine the ways consumers pay more than they realize for the things that they buy. Consumers end up borrowing money, even for a simple $5 item, every time they fail to pay the full amount of their credit card bills by the due date. These lessons introduce some of the hidden costs involved with borrowing money.

Lesson 9: Interest

Pre-Lesson Vocabulary Practice

Study the boldfaced terms in the following sentences. Then match the definitions on the right to the terms below.

_____ ❶ **Substitute** $750 for the principal.

_____ ❷ Change 9 months to a **fraction** of a year.

_____ ❸ Jin **borrowed** $800 from his parents.

_____ ❹ Jin **agreed** to pay them back.

_____ ❺ Jin agreed **to pay them back.**

_____ ❻ Compound interest is calculated at regular **intervals** such as every three months.

a. specific periods of time

b. a part of

c. replace, put in its place

d. to return money

e. to take as a loan

f. consent, go along with

With a partner take turns choosing a term from the list and then giving the meaning.

Below is a review of vocabulary items from previous lessons. Read the definitions below. Then fill the blanks with the appropriate terms from the list.

_____ ❼ to find a specific dimension or quantity

_____ ❽ to use numbers to determine or figure something out

_____ ❾ by the year, per year

_____ ❿ to work for, to make money

_____ ⓫ an amount of money placed in a bank account

_____ ⓬ the amount of money remaining in a bank account

_____ ⓭ an organization or a company that deals with money, such as a bank

a financial institution

to calculate

annual

to measure

a deposit

to earn

the balance

Now try another review. Write the terms on the right in the appropriate blanks.

_____ ⓮ a formula

_____ ⓯ the first quarter of a calendar year

_____ ⓰ a fraction

_____ ⓱ percent

_____ ⓲ a decimal

January–March

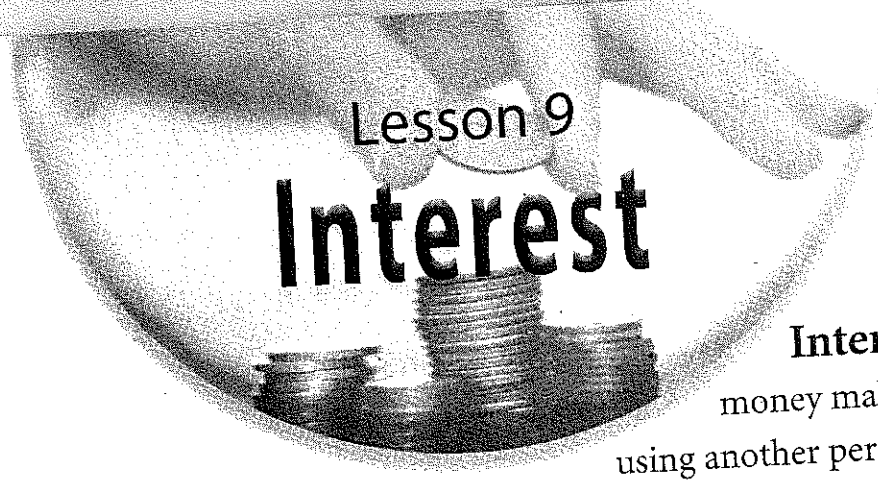
0.04

%

$i=prt$

$\frac{1}{4}$

Answers are on page 264.



Lesson 9

Interest

Interest is money that money makes. Interest is a payment for using another person's money. A bank pays a customer interest for using the customer's money. A customer pays interest for using the bank's money in a loan.

Interest is measured in dollars and calculated as a percent of **principal**. Principal is the amount of money on which interest is paid. Principal is the amount of savings in a customer's account in a bank or the amount of a loan.

The formula for calculating interest is:

$$interest = principal \times rate \times time$$

Principal is the money on which interest is paid.
Rate is the percent used to calculate the interest.
Time is a number of years or a fraction of a year.

Simple interest is money paid on only the principal.

Example 1 Find the simple interest on \$750 at 4% annual interest for 3 years.

Solution Change 4% to a decimal: 4% = 0.04
Substitute \$750 for the principal, 0.04 for the rate, and 3 for the time.

$$interest = \$750 \times 0.04 \times 3 = \$90$$

Example 2 What is the new principal on \$1,000 that has earned 6% annual interest for 9 months?

Solution Change 6% to a decimal: 6% = 0.06.
Change 9 months to a fraction of a year.

$$9 \text{ months} = \frac{9}{12} = \frac{3}{4} \text{ year}$$

$$interest = \$1{,}000 \times 0.06 \times \frac{3}{4} = \$45$$

Add the interest to the principal: \$1,000 + \$45 = \$1,045.

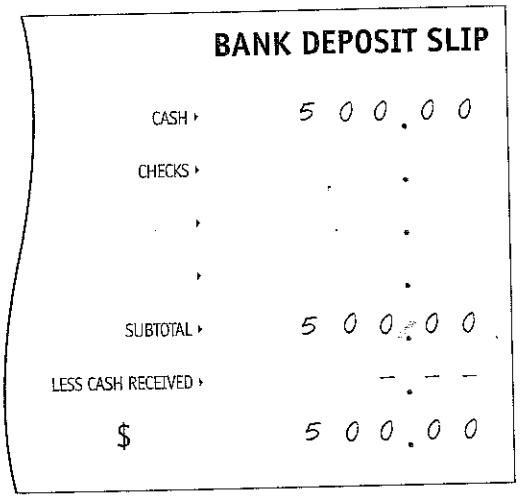
The formula for interest is $i = prt$. This formula expresses the relationship among interest, principal, rate, and time. If you know three of the amounts, it is easy to calculate the fourth amount.

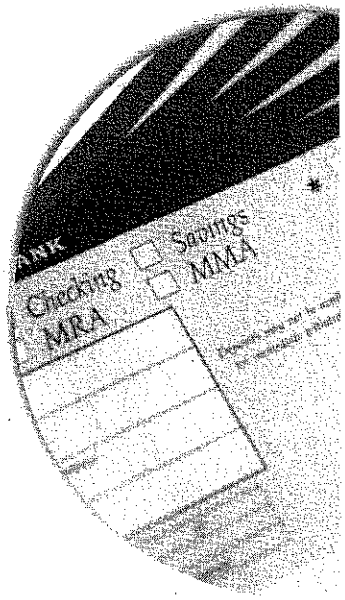
To find the interest rate, solve for r in the formula: $r = \frac{i}{pt}$

To find the time, solve for t in the formula: $t = \frac{i}{pr}$

To find the principal, solve for p in the formula: $p = \frac{i}{rt}$

Example 3





Martha deposited $500 in a savings account that earned simple interest. At the end of three years the account had a balance of $567.50. Find the rate of simple interest that she earned on the savings account.

Solution Find the total amount of interest:

$\$567.50 - \$500 = \$67.50$

Substitute \$67.60 for i, \$500 for p, and 3 for t in the formula $r = \frac{i}{pt}$.

$$r = \frac{\$67.50}{\$500 \times 3} = \frac{\$67.50}{\$1{,}500}$$

$r = 0.045 = 4.5\%$

Example 4 Jin borrowed $800 from his parents and agreed to pay them back with 6% simple annual interest. Jin paid his parents a total of $872. How long did it take Jin to pay back the money he borrowed?

Solution Find the total amount of interest: $872 – $800 = $72.

Substitute $72 for i, $800 for p, and 0.06 for r in the formula $t = \frac{i}{pr}$.

$$t = \frac{\$72}{\$800 \times 0.06}$$

$$t = \frac{\$72}{\$48} = \frac{3}{2} = 1\frac{1}{2} \text{ years or 1 year and 6 months}$$

Compound interest is money paid on both the principal and the interest that has already been paid on the principal. Compound interest is calculated at regular intervals such as every three months (quarterly), every month, or even every day.

Not surprisingly, compound interest is complicated. Financial institutions use computer programs to make their calculations. However, to understand compound interest, follow the next example carefully.

Example 5 What is the new principal at the end of one year on $2,000 at 8% annual interest if the interest is compounded quarterly?

Solution The interest for the first quarter is:

$$\text{interest} = \$2{,}000 \times 0.08 \times \frac{1}{4} = \$40$$

The principal at the end of the first quarter is:

$$\$2{,}000 + \$40 = \$2{,}040$$

The interest for the second quarter is:

$$\text{interest} = \$2{,}040 \times 0.08 \times \frac{1}{4} = \$40.80$$

The principal at the end of the second quarter is:

$$\$2{,}040 + \$40.80 = \$2{,}080.80$$

The interest for the third quarter is:

$$\$2{,}080.80 \times 0.08 \times \frac{1}{4} = \$41.616 \text{ or } \$41.62$$

The principal at the end of the third quarter is:

$$\$2{,}080.80 + \$41.62 = \$2{,}122.42$$

The interest for the final quarter is:

$$\$2{,}122.42 \times 0.08 \times \frac{1}{4}$$

$$= \$42.4484 \text{ or } \$42.45$$

The principal at the end of the final quarter is:

$$\$2{,}122.42 + \$42.45 = \$2{,}164.87$$

Notice that for each quater the new princapal is multiplied by the same rate, 0.08 and the same rime, $\frac{1}{4}$. You can simplify $0.08 \times \frac{1}{4}$ to 0.02.

Compound interest can be calculated using the steps above, however, using a computer program is much easier.

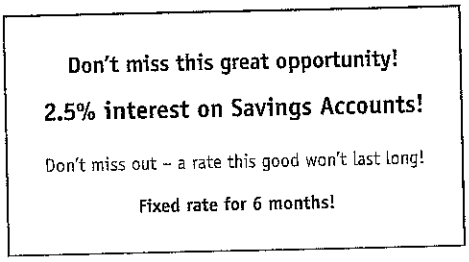
To solve the problems in the next exercise, review:

- multiplying decimals, page 231
- finding a percent of a number, page 236
- interest, page 238

Exercise 9

Part A

Solve each problem. Use a calculator and the formulas on page 95 of this lesson.



❶ What is the simple yearly interest on \$750 at $2\frac{1}{2}\%$ annual interest?

❷ Find the simple interest on \$1,800 at 2.5% annual interest for eight months.

❸ What is the new principal on \$3,000 that earned $8\frac{1}{2}\%$ annual interest for three years and six months?

❹ Chan borrowed \$500 from his brother. One year and three months after he borrowed the money, Chan paid his brother \$562.50. What interest rate did Chan pay?

❺ What is the simple interest on \$2,000 at $5\frac{1}{4}\%$ for four years?

❻ To buy new furniture, Jane and Ike borrowed \$1,600. They agreed to pay 14.5% annual interest. When they paid back their loan, they wrote a check for \$1,716. For how long did they borrow the money?

❼ Shirley borrowed money at $9\frac{3}{4}\%$ annual interest. She paid back all the money including \$195 in interest four months after she borrowed the money. How much did Shirley borrow?

❽ After one and a half years, the account into which Bill deposited \$900 had a total of \$1,001.25. What interest rate did he earn on his deposit?

❾ Find the simple interest on \$3,600 at $4\frac{3}{4}\%$ annual interest for nine months.

❿ Imani borrowed \$400 from her sister. Imani agreed to pay 7% simple annual interest. When she paid the money back, she gave her sister \$470. For how long did Imani borrow the money?

Part B

⓫ Keiko put \$5,000 in an account that earned 9% annual interest. If the interest was compounded once each year, how much was in Keiko's account at the end of three years?

⓬ Wu put \$1,400 in an account that earned 3.5% annual interest. If the interest is compounded each month, how much will be in Wu's account at the end of three months?

Answers are on page 264.