The *commutative* and *associative* properties of addition and multiplication can help you simplify a numerical or algebraic expression.

	Addition	Multiplication
Commutative property	$a + b = b + a$	$a \cdot b = b \cdot a$
Associative property	$(a + b) + c = a + (b + c)$	$(a \cdot b) \cdot c = a \cdot (b \cdot c)$

The associative property allows you to express $3 + (0.06 + 8)$ and $(5.4 \cdot 2) \cdot 10$ without parentheses.

$$3 + (0.06 + 8) = 3 + 0.06 + 8 = 3.06 + 8 = 11.06$$
$$(5.4 \cdot 2) \cdot 10 = 5.4 \cdot 2 \cdot 10 = 10.8 \cdot 10 = 108$$

Simplify.

EXAMPLE $(11.23 + x) + 1.77$

$$= (x + 11.23) + 1.77 \quad \text{Commutative property for addition}$$
$$= x + (11.23 + 1.77) \quad \text{Associative property for addition}$$
$$= x + 13 \quad \text{Simplify.}$$

1. $8a + (12 + 3a)$

2. $(200)(50y)(5)(2x)$

3. $2x + 3y - x + 4y$

4. $0.5(8x)(2a)$

Two other properties that can help you simplify expressions are:

Distributive property	$a(b + c) = ab + ac$
Definition of subtraction	$a - b = a + (-b)$

Remember to subtract a number is to add its opposite.

EXAMPLE $11x - 6(x - 1)$

$$= 11x + (-6)[x + (-1)] \quad \text{Definition of subtraction}$$
$$= 11x + [(-6)x + (-6)(-1)] \quad \text{Distributive property}$$
$$= [11x + (-6x)] + 6) \quad \text{Associative property of addition}$$
$$= 5x + 6 \quad \text{Add like terms.}$$

5. $4.03x + 5.97 - 0.03x$

6. $28 - (8.5 - 10c)$

7. $40a - 20b - 9a$

8. $(4.2 - 3p) - 2p$

9. $-1(x^2 - 1.06) + x$

10. $y^3 - (7y^3 + 7)$

A DOLLAR *Saved*.

MARIA IS IN THE SAME HIGH SCHOOL as Alex, Jeff, and their friends. She and her friends face some of the same tough choices as their other classmates. Most of them have earned some money of their own and are enjoying the sense of independence it has brought them. They are eager to be out of school and completely on their own. They also realize the importance of choosing a career that they will find satisfying. For many this choice means attending college for further training, thus delaying total independence for a while. Many of these students' parents have already been saving money toward this extra education and have been encouraging their sons and daughters to save as well.
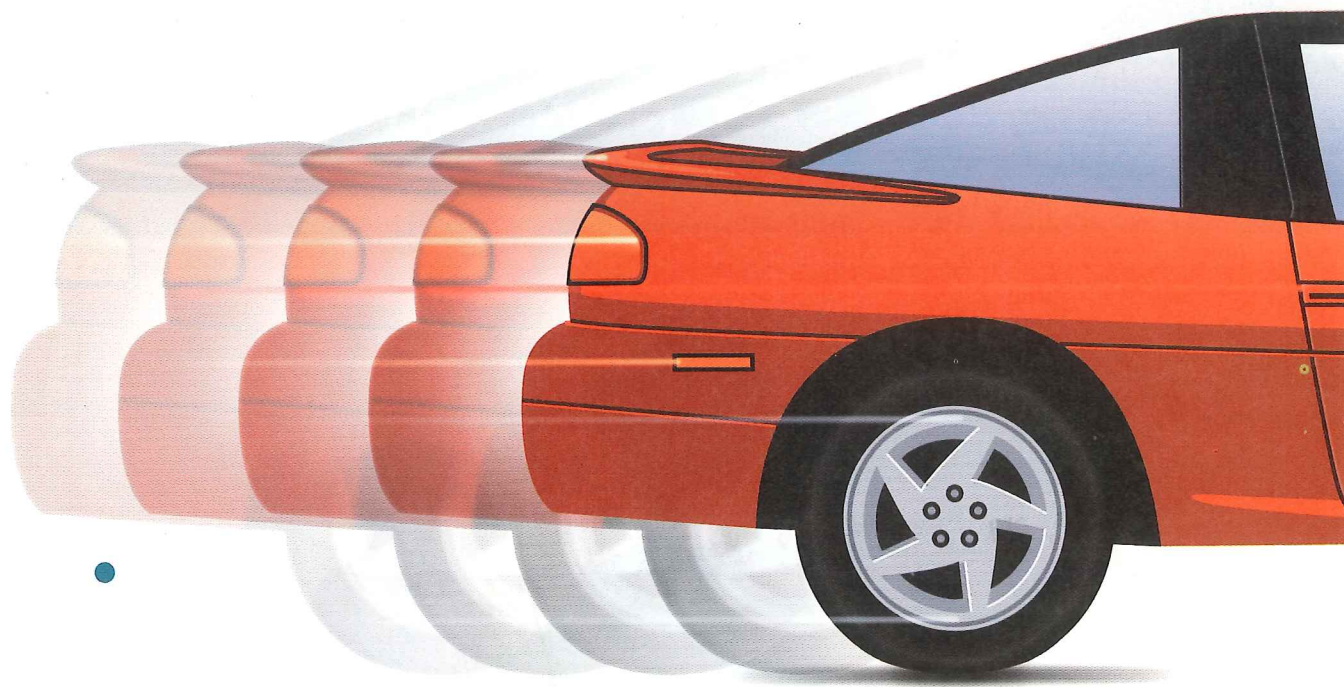
In this chapter, Maria and her friend Nelson will help us examine how people go about saving money for purchases that require more cash than can be obtained easily from a regular salary. Maria dreams of buying her own car and saves money toward that goal each month. As a result, she learns about various savings institutions and how they pay interest on her money. Nelson looks into interest in greater detail, discovering how often interest may be paid on a savings account and what is meant by an annual interest rate.

Their friend Olivia will help explain to us the impact of the Federal Reserve System on both savers and consumers. She discovers that transferring money over great distances takes only minutes. She also learns that the Federal Reserve System plays a key role in managing the country's money supply.
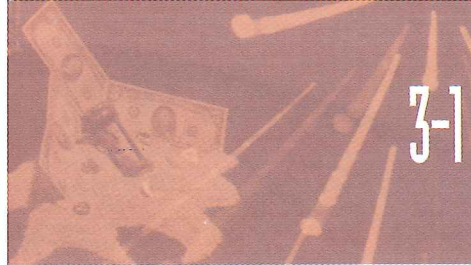
Maria does not think of herself as extravagant but ever since she began earning money on her own, she has noticed several items that she would like to buy. She was even able to buy a small car just three months ago after she persuaded her father that she would be able to pay for the monthly installment charges, insurance, gasoline, and regular maintenance. He helped her pick out the car, which had only 14,000 miles on it and had been owned and maintained by a nationwide car-rental chain. So far she has not had to buy so much as a new windshield wiper blade.

It was not easy for Maria to convince Dad that she could keep up the car payments. For six months she put half of her weekly paycheck from a fast-food restaurant into her savings account at the bank. Dad had told her to keep the money for her college expenses next year, but what he really wanted to find out was whether Maria would be able to save up money for the car. After six long months, Dad was convinced that she could.

Maria will share with us some of what she has learned about saving money. She has decided that saving isn't so hard after all and that maybe she will save even more so that she can buy some of the things she did without during the six months. Perhaps she can even take her friend Melody out to lunch to celebrate Melody's birthday.

- *Recognize why people save money.*
- *Identify the places where people commonly deposit savings.*
- *Explain factors such as interest rates and liquidity that influence the return that your money can earn at financial institutions.*
- *Explain the differences between regular savings accounts, money market accounts, and certificates of deposit.*

WHY PEOPLE SAVE

People have many reasons for saving—to pay for a vacation, stereo or sports equipment, or a major appliance, for example. Many young people also save to help pay for college.

Maria's father had two reasons for saving. First, soon after Maria began working, he realized that, apart from Maria's own wishes, the family actually did need another car, since arranging transportation for everyone too often required skillful coordination. Second, he realized that by helping Maria follow through with her plan to pay for the car, he could not only ease the family's transportation problem but, perhaps more important, also help his daughter to develop the self-discipline she needed to save regularly.

As most people do, Maria's family knows that unforeseen events such as an accident, illness, or the loss of a job can cause a sudden loss of income. For this reason, financial advisors recommend a savings reserve of at least three to six months' salary.

It takes self-discipline and consistency of purpose to maintain a habit of saving each month, so developing these admirable qualities is a strong reason for acquiring that habit. In addition to its positive effect on your character, the saving habit also is directly rewarding. Whenever you let a financial institution such as a bank use your money, it will pay you interest on that money.

WHERE PEOPLE SAVE

Once Maria had made a firm decision to open a savings account, she had to decide what kind of institution she would choose. She knew that she had several options such as commercial banks, savings banks, savings and loan associations, and credit unions. Saving in these institutions is usually safe and offers a relatively fixed rate of return on money.

Commercial banks offer a wide variety of services that persuade many families to select this kind of bank as the center of their financial affairs.

These services include offering checking and savings accounts, making loans, issuing credit cards, and renting safe-deposit boxes. Commercial banks usually also sell traveler's checks and money orders. They also offer financial counseling and trust and investment services.

Savings banks operate in much the same way as commercial banks; their services include savings accounts, check cashing, safe-deposit boxes, and savings bank life insurance. They also specialize in real-estate loans. Savings banks are common in the northeastern part of the United States.

Savings and loan associations, sometimes also called *thrift institutions,* generally lend money for home purchases and home construction.

Credit unions are not-for-profit financial institutions that pay interest on members' savings and use these savings to make loans to their members. Credit unions have membership requirements. The members are people who belong to a professional organization, church, company, or other group that has a common social, economic, political, or religious basis. Maria's father, along with 7500 other federal employees, is a member of their county's Federal Employees Credit Union.

HOW TO SELECT A SAVINGS ACCOUNT

After Maria discovered the many types of savings institutions that are eager to use her money, she began to wonder why she should choose one kind of savings institution over another. One reason is that some institutions pay more *interest* than others.

When Maria's money is put to work, she should expect it to work as hard as possible to earn interest with a high degree of safety. *Interest* is the return savers get from letting someone else use their money. The *interest rate* is the most important factor in determining the interest a savings account will earn. By calling around to various institutions, Maria found out that interest rates vary from place to place. She also learned that the *liquidity* of a savings instrument influences the interest rate that she can get on her savings. **Liquidity** means the ease and speed with which savings can be converted to cash. The longer the savers are willing to tie up their money, the higher the interest rate they will receive.

Regular Savings Accounts   The most liquid or flexible choice for Maria is a **passbook** or **regular savings account,** an account that allows her to make deposits and withdrawals at any time. A regular savings account accepts deposits of any size and allows you to withdraw any amount that does not exceed your total balance. Maria's family already has its emergency-fund savings in a regular savings account.

Money Market Accounts   If you can do without the convenience of a regular savings account, you may be able to obtain a higher rate of interest than would otherwise be the case. One way you can do this is to open a **money market account**. In exchange for a higher rate of interest, you may have to accept some restrictions on your access to the account. For more details on money market accounts see Lesson 8–1.

Certificates of Deposit Another way to obtain a higher rate of interest is to purchase a **certificate of deposit (CD)**. A certificate of deposit is less liquid than a regular savings account. It is purchased at a bank by filling out a special form that records the amount of savings a person chooses to place in a special account. The CD specifies a fixed amount of money that must be deposited and a period of time during which the saver promises not to withdraw money from the account. The interest rates for six-month certificates are tied to the weekly U.S. Treasury bill interest rate.

Since the bank has the use of your CD money for a guaranteed period of time, it can afford to pay a higher rate of interest than on a regular savings account. The federal government requires the bank to impose stringent penalties if you make an early withdrawal from a certificate of deposit account. For example, you can be penalized three months' interest on certificates of less than one year if you withdraw the money before the date that you originally agreed to.

Maria's family has placed her school tuition money in certificates of deposit because it is willing to accept the restrictions on its ability to withdraw the money in exchange for the relatively high interest that the certificates pay.

Ask Yourself

1. What emergencies do people usually save for?

2. How much money do financial advisors recommend that people save to cover emergencies such as sickness or the loss of a job?

3. What are three types of institutions in which people usually keep their savings?

4. What are four of the services offered by commercial banks?

5. What examples can you give of the kind of people who might belong to the same credit union?

6. What is interest?

ALGEBRA *REVIEW*

In each formula, substitute the given values. Then solve to find the value of the remaining variable.

Example

$$p = 2l + 2w; p = 80, l = 15$$
$$80 = 2(15) + 2w$$
$$80 = 30 + 2w$$
$$50 = 2w \quad \text{Subtract 30 from each side.}$$
$$25 = w \quad \text{Divide each side by 2.}$$

1. $A = lw; l = 2.6, w = 7$

2. $i = 250rt; r = 0.07, t = 3$

3. $s = l + w; l = 16, w = 4.6$

4. $B = p + i, B = 302.5,$ $p = 250$

5. $i = p(0.045)t; p = 5000,$ $t = 15$

6. $i = prt; p = 1500, r = 0.05,$ $t = 10$

7. $B = p + i; p = 750,$ $i = 30.63$

8. $B = p + prt; p = 100,$ $r = 3\%, t = 4$

SKILL 1

The amount of money invested is called the **principal** p. **Simple interest** i can be determined using the following formula. The **rate of interest** r is a percent of the principal.

Simple Interest Formula

$i = prt$ where i = interest
                        p = principal
                        r = rate of interest
                        t = time

EXAMPLE 1   Maria can save $85 per week from her paycheck. After saving for a year, she decides to buy a one-year CD that pays 4% simple interest.

QUESTIONS   1. How much will Maria save in 52 weeks?

                  2. How much interest will the CD earn in 1 year?

                  3. How much will Maria's CD be worth after 1 year?

SOLUTIONS

1. Total savings = weekly savings • number of weeks
                = 85 • 52
                = 4420

   In 52 weeks, Maria will save $4420.

2. To find the interest after 1 year, Maria uses the formula for simple interest.

   $i = prt$
   $i = 4420 \cdot 0.04 \cdot 1$
   $i = 176.80$

   The CD earns $176.80 in interest.

3. The balance in the CD will be the principal plus the interest.

   Balance = principal + interest
        $B = p + i$
        $B = 4420 + 176.80$
        $B = 4596.80$

   The total amount in the CD at the end of one year is $4596.80.

If Maria leaves the money in the CD, then in the second year the bank will pay interest on both the original principal and on the previous year's interest. In other words, instead of being simple interest, as in year 1, the interest for year 2 and all later years will be *compound interest.* Compound interest is discussed in Lesson 3–2.

COMPOUND INTEREST: MONEY THAT GROWS

Maria's friend Nelson was impressed by the discipline that she imposed on herself to save money to cover the operating expenses of a car. He knew that there were times when Maria was tempted to spend some of her savings, but he also saw how fast those savings were growing. In fact, he discovered that her total account balance was larger than the money she had put in the bank. Maria explained that her savings were earning interest. Nelson saw this as the bank's way of rewarding her for keeping her money in the bank.

Nelson spends his extra time writing programs in the computer lab. He received recognition at a science competition for a simulation program that projects the changing growth patterns of the great forests in the Western Hemisphere and the impact those changes could have on human lives. He became interested in the topic when a lumber company wanted to cut some of the trees from a national forest where he and his family have gone camping.

As a result of his study, Nelson learned how long it takes to grow new trees. He began to wonder if growing new money from old money was anything like that.

OBJECTIVES: *In this lesson, we will help Nelson to:*

● *Compute the total interest for a savings account when the interest is compounded annually, semiannually, or quarterly.*

● *Compute interest in a savings account using the compound interest formula.*

For each item below, draw a bar graph to show the number of weeks it will take to save enough money to buy each item. In each case, assume that you save $25 per week.

19. Auto-focus camera, $189.99

20. VCR, $199.99

21. Keyboard, $89.95

22.–24. Draw a bar graph like the one for Exercises 19–21 assuming you save $40 per week.

MIXED REVIEW

1. A real-estate salesperson receives 4% of the first $100,000 of the selling price of a home and 6% of any amount over $100,000. How much commission does the salesperson receive on a home that sells for $250,000?

2. Jared has a part-time business videotaping weddings. His rates are $60 for the ceremony and $110 if both the ceremony and the reception are covered. Last year he was able to videotape 29 weddings, 4 of which included the reception. His expenses for the year were $900. What were his net earnings for the year?

Fill in the table below using the following information about Essex National Bank checking accounts.

Interest is paid on the beginning balance at the rate of 0.4% per month.
The service charge is $3.50 per month.
The cost per check is $0.03.
There are no additional charges regardless of the amount of the balance.

	Beginning Balance	Number of Checks	Interest Earned	Service Charges	Cost of Checks	New Balance
3.	$ 800	14				
4.	16,000	27				
5.	166	8				

Suppose that on October 7 your checking account balance is $426.67.

6. What will be your balance after depositing a $75.81 check from another state on October 8?

7. What will be your balance after you write a check of $350 against your account on October 9?

8. Why might it not be a good idea to write a check for $80 on October 10?

9. Keith earns $7.50 an hour and $1\frac{1}{2}$ times that amount for time over 20 hours in 1 week. What is his pay for 23 hours of work?

EXERCISE YOUR SKILLS

1. Why would a less liquid savings account earn higher interest than a more liquid account?

2. Why do you think that the federal government imposes heavy penalties for liquidating a certificate of deposit before its maturity date?

3. Why should savers deposit emergency savings in a regular savings account rather than in a certificate of deposit?

A bank pays 4% simple interest on a one-year CD. The following table shows amounts saved for a year to buy a CD. Find out how much is saved, how much interest is earned by the CD in 1 year, and the total amount of money in each account after the bank has credited the interest to the accounts.

	Amount Saved per Week	Number of Weeks	Total Saved	Interest Earned	Total in Account
4.	$ 30	52			
5.	50	48			
6.	100	50			

Dwight is considering buying some items. Find out how much he can save and how long he will have to save to be able to afford each item below when he saves at the stated rate.

	Amount Saved per Week	Number of Weeks Needed	Total Saved
7.	$15		
8.	20		
9.	25		
10.	50		

Sale: $139.99 . . Reg. $159.95
Murray's "Pro-Master" 3–9 irons, pitching wedge, 1–3–5 woods. Lightweight steel shafts. Stainless-steel woods.

	Amount Saved per Week	Number of Weeks Needed	Total Saved
11.	$15		
12.	20		
13.	25		
14.	50		

Diamond/Sapphire Ring 14K gold. Elegant setting.
Regular $275.00
Special Price $199.99

	Amount Saved per Week	Number of Weeks Needed	Total Saved
15.	$15		
16.	20		
17.	25		
18.	50		

Sale: $149.99 . . . . . Reg. $200
Teak Portable CD Player with 3-beam laser pick-up. Music shuffle for random playback. Uses 4 AA batteries (not included).

From the graph, it will take 3 weeks to save enough for the stereo, 4 weeks for the watch, 5 weeks for the bicycle, and 6 weeks for the camera.

TRY YOUR SKILLS

A bank pays 3.5% simple interest on a one-year CD. The table below shows the amounts that Maria and her friends have saved for a year to buy a CD. Find out how much is saved, how much interest is earned by the CD in one year, and the total amount of money in each account after the bank has credited the interest to the accounts.

	Amount Saved per Week	Number of Weeks	Total Saved	Interest Earned	Total in Account
1.	$10	52			
2.	15	48			
3.	20	50			
4.	25	52			
5.	30	50			
6.	40	48			

One of Maria's friends, Donna, decided to save up for a $330 vacation. Find out how many weeks she needs to save. How long will she have to save for each of the indicated weekly savings?

	Amount Saved per Week	Number of Weeks Needed	Total Saved
7.	$20		
8.	32		
9.	18		
10.	30		
11.	35		
12.	40		

For each item below, draw a bar graph to show the number of weeks it will take to save enough money to buy each item. In each case, assume that you save $25 per week.

13. Car stereo system, $139.99

14. Portable AM/FM stereo, $219.99

15. Computer, $499

16. 10-speed bicycle, $339.99

SOLUTION

To find the number of weeks of savings required, Sarita prepares a bar graph using a spreadsheet program. She wants the graph to show equally spaced $25 levels so that she can easily see the number of weeks of savings required for each of the four items. Sarita begins by creating the following spreadsheet:

	A	B
1	stereo	59.87
2	watch	89.99
3	bicycle	109.99
4	camera	139.99

Most spreadsheet programs allow you to graph by selecting an option such as GRAPH or CHART. Choose the type of graph, in this case, a **bar graph.** Then use the option that allows you to choose minimum and maximum values on each axis.

Sarita chooses 0 for the minimum and 150 for the maximum on the y-axis.

You can also select an option to show horizontal gridlines. You may be able to select the spacing between gridlines by using a command called SCALE, INCREMENT, or something similar.

Sarita selects 25 for the scale.

The spreadsheet program will automatically label the y-axis (the left vertical axis) with the labels 0, 25, 50, 75, 100, 125, and 150 with or without dollar signs, as you choose. The spreadsheet menu will also let you choose an option with a name such as INTERIOR LABELS that lets you position each of the four sales prices above its graph. You will probably have to type the text labels yourself. Fortunately, you can instruct most spreadsheet programs to place certain kinds of text inserts (headings, for example) in their proper position.

Sarita chooses the INTERIOR LABELS option. Then she types in the labels for the top, bottom, and right side of the graph. The graph is shown below.

WATCH SARITA'S SAVINGS GROW
$25 equals one week's savings
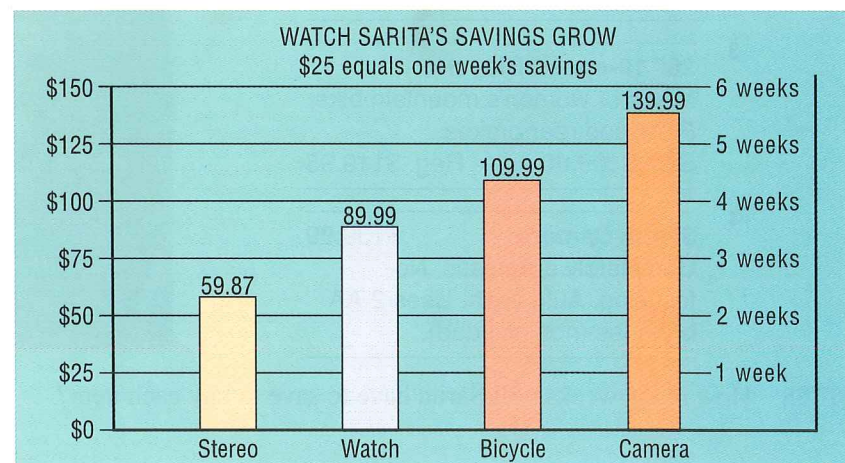
EXAMPLE 2 Maria's friend Dwight wants to buy a golf bag. He finds one on sale for $59.84. The sale price will be in effect for 1 month.

Golf Bag . . . . . . SALE $59.84
Less than half original price! Genuine leather, sturdy construction. Just like the ones the pros use!

QUESTION If Dwight can save $22 per week, will he have enough money to buy the bag before the sale is over?

SOLUTION

Weeks needed = cost of golf bag ÷ amount saved each week
$$= 59.84 \div 22$$
$$= 2.72$$

Dwight will have enough money in three weeks, so Dwight will have enough money to buy the golf bag before the sale is over.

SKILL 3

EXAMPLE 3 Maria's sister Sarita would like to buy one or more of the items shown below. She can save $25 each week from her salary.

1.
Audio Box   3-bank EQ.
Local-distance switch.
Time/frequency display switch.
Sale $59.87   Reg. $75.00

2.
Quartz Watch
Yellow case with black band.
Measures elapsed and lap time.
Sale $89.99   Reg. $135.00

3.
26" 10-speed Bicycle
Men's or women's mountain bike.
Front and rear brakes.
Sale $109.00   Reg. $119.95

4.
35mm Camera $139.99
Completely automatic. No focusing. Auto flash. Uses 2 AA batteries (not included).

QUESTION How many weeks will Sarita have to save to buy each item?