Chapter 8

The Stock Market

What do you think Frank Hubbard meant in this quote?

The safe way to double your money is to fold it over once and put it in your pocket.

—Frank Hubbard, journalist

In the future, you will incur many expenses, such as a home, automobile, insurance, food, clothing, and health care. Some are major expenses and some are minor, but each costs money. To have money for major expenses, it helps to have your savings grow in value. You have already learned how bank interest can help your money grow. However, the prevailing bank interest rates limit the degree to which your money can grow. Investing can help money grow in value, and there is no limit to the amount of growth, but you can also lose all of your investment.

You need to find a personal balance between risk and reward when you make choices about investments. Investments are never without questions. Did you miss the chance to make more money because you were being overly cautious? Was the investment too risky? Did you risk losing principal by investing in something that may not have had a sound foundation?

Investors struggle with these questions every day. The stock market is a forum in which the investment risk/reward balance is put to the test. Will the market advance? Will the market decline? No one can be certain. Will the corporations you choose flourish, grow, and succeed, or falter? With a strong knowledge of the stock market, corporations, and investment strategies, you as an investor can make decisions that are based on experience, data, trends, and mathematics.
Corporations sometimes choose names that are personal, humorous, historical, or psychological. Many are acronyms, where a new word is created by the first letters of several words. Below are some well-known corporations and how their names were established.

Amazon.com was originally known as Cadabra.com. Its founder selected Amazon as a corporate name because the Amazon River has the largest volume of any river in the world. He also wanted a name that began with “A” so that alphabetically, it would appear at the top of a list.

Coca-Cola is a name that has its origins in the ingredients of the product—coca leaves and kola nuts. The founder, John Pemberton, changed the “K” in kola to a “C” for appearance purposes.

Adidas is taken from the name of the company’s founder, Adolph (Adi) Dassler.

eBay was created by Pierre Omidyar, who originally wanted to use the name Echo Bay. The name was already taken by a gold mining company, so he shortened it to eBay.

LoJack is a corporation that makes automobile antitheft devices. The name is a humorous adaptation of the word “hijack.”

Aflac is an acronym for the American Family Life Assurance Company.

Xerox comes from a Greek expression for “dry writing.” The Xerox process was invented in 1937 by law student Chester Carlson.

CHAPTER OVERVIEW
Most students are familiar with the existence of the market but are unfamiliar with how it works. The concept of risk and reward is a constant presence. In this chapter, students use mathematics to understand market events and make wise decisions about personal investments.
How Do Businesses Start?

Think of everything you use on a daily basis, from complex electronic devices to simple items like straws, paper clips, and toothbrushes. Have you ever wondered who invented them, or how each has been improved upon? Some inventions provide an opportunity to build a business, but not all. It takes imagination, money, and effort to create a successful business. The money used to start or expand a business is called capital.

A business owned by one person is a sole proprietorship. The owner, or proprietor, can hire people to help run the business, but these employees are not owners. The owner is responsible for all expenses, including labor and raw materials used in manufacturing a product or providing a service. The money left after all expenses are paid is profit. The owner of a sole proprietorship is entitled to all of the profits. However, the owner is responsible, or personally liable, for any losses. Even if the business does not make a profit, the owner must still pay all of the bills of the business.

A business that is owned by a group of people, called partners, is a partnership. Partners share the profits and the responsibility for any losses. The partners are personally liable for any losses. Personal liability may require risking personal property. Sole proprietors and partners must consider this possibility when creating a business.

A corporation is a business organization that can be owned by one person or a group of people. Each owner who invests money in the corporation receives shares of stock in the corporation. The owners are called shareholders. Stock certificates are used as proof of ownership. Unlike sole proprietorships and partnerships, the shareholders in a corporation have limited liability—each
owner cannot lose more than the value of his or her share of the business. The number of shareholders in a corporation depends on the structure of the business. When all of the shares are owned solely by a few individuals, and are not available for sale to the public, the corporation is a private corporation, also known as a privately held corporation. The New York Yankees are an example of a private corporation. So is Lego. Your local car dealership is most likely a private corporation. When anyone can purchase stock in a corporation, the corporation is a public corporation. You might already be familiar with public corporations, such as Nike, McDonald’s, Xerox, and Apple. These corporations are owned by housewives, doctors, plumbers, teachers, students, senior citizens—anyone who buys a share in the corporation. If a shareholder owns more than 50% of the shares, that shareholder owns a majority of the shares. The prices of shares of stock in public corporations can be found in newspapers, on television business channels, and on the Internet.

Skills and Strategies

When a business is owned by more than one person, the owners do not necessarily own equivalent portions of the business. Ratios and percentages can be used to represent the financial responsibility of owners and partners. Recall the relationship between decimals and percentages.

To convert a decimal to a percentage, multiply the decimal by 100 and annex a percent sign.

To convert a percentage to a decimal, divide the percent by 100 and drop the percent sign.

EXAMPLE 1

Michelle invests $15,000 in a partnership that has four other partners. The total investment of all partners is $240,000. What percent of the business does Michelle own?

SOLUTION

Represent Michelle’s investment as a fraction of the total investment. Convert the fraction to a decimal and write as a percent.

Write as a fraction.  
\[
\frac{\text{Michelle’s investment}}{\text{Total investment}} = \frac{15,000}{240,000}
\]

Divide.  

\[
15,000 \div 240,000 = 0.0625
\]

Multiply by 100. Write a percent sign.  

\[
0.0625 \times 100 = 6.25\%
\]

Michelle owns 6.25% of the partnership.

Kyle invests $20,000 in a partnership that has five other partners. The total investment of the partners is $160,000. What percent of the business is owned by the five other partners?
**EXAMPLE 2**

The total number of shares of stock in Bulls Corp is 650,000. Mike owns 12% of the shares. How many shares of Bulls Corp stock does he own?

**SOLUTION** Let \( x \) represent the number of shares Mike owns.

Express 12% as a fraction. 

\[
12\% = \frac{12}{100}
\]

Write a proportion. 

\[
\frac{12}{100} = \frac{x}{650,000}
\]

Cross multiply. 

\[100x = (12)(650,000)\]

Find the product. 

\[100x = 7,800,000\]

Divide both sides by 100. 

\[
\frac{100x}{100} = \frac{7,800,000}{100}
\]

\[x = 78,000\]

Mike owns 78,000 shares of Bulls Corp.

---

**EXAMPLE 3**

Three partners are investing a total of $900,000 to open a garden and landscaping store. Their investments are in the ratio 2:3:5. How much does the partner that invested the least contribute?

**SOLUTION** Use the ratio 2:3:5 to write an expression for the amount each partner invested.

Let \( 2x \) represent the amount invested by the first partner.

Let \( 3x \) represent the amount invested by the second partner.

Let \( 5x \) represent the amount invested by the third partner.

Write an equation showing the three investments total $900,000. 

\[2x + 3x + 5x = 900,000\]

Combine like terms. 

\[10x = 900,000\]

Divide each side of the equation by 10. 

\[x = 90,000\]

The partner that invested the least is represented by the expression \( 2x \).

Substitute $90,000 into the expression. 

\[2(90,000) = 180,000\]

The partner who invested the least amount contributed $180,000.

---

**CHECK YOUR UNDERSTANDING**

Jillian owns 60% of the stock in a private catering corporation. There are 1,200 shares in the entire corporation. How many shares does Jillian own?

**Answer** $20,000 and $25,000

---

**EXTEND YOUR UNDERSTANDING**

Two partners each invest 35% in a startup business. They need to find another investor for the rest of the money. What percent of the business will that person own? Write a ratio to represent the investments in the business.
Applications

Genius is 1% inspiration and 99% perspiration. Accordingly, a genius is often merely a talented person who has done all of his or her homework.

—Thomas Edison, inventor

1. What do you think Thomas Edison meant by the word perspiration? How do those words apply to what you’ve learned about businesses in this lesson? See margin.

2. Tomika owns \( \frac{3}{5} \) of a law partnership. What percent of the partnership does she own? 60%

3. Ryan owns \( \frac{3}{8} \) of a florist shop worth $76,000. What is the value of Ryan's share of the business? $28,500

4. A corporation issues 1,200,000 shares of stock to shareholders. How many shares must a shareholder own to have a majority of the shares? 600,001

5. Elisa owns 28% of Grudman Corp. The rest of the shares are owned equally by the remaining six shareholders. What percent of the corporation does each of the other shareholders own? 12%

6. Julie and Kristen are the partners in a local sporting goods shop. They needed $51,000 to start the business. They invested in the ratio 5:12, respectively.
   a. How much money did each invest? Julie, $15,000; Kristin, $36,000
   b. What percent of the business was owned by Kristin? Round to the nearest tenth of a percent. 70.6%
   c. If the business grows to $3,000,000, what percent of it will Julie own? Round to the nearest tenth of a percent. 29.4%

7. Joe, Thea, and Taylor invested in a partnership in the ratio 1:4:7, respectively. Years later, when the partnership was worth $1.6 million, Thea decides to go to graduate school and sells her part of the partnership to Joe.
   a. How much would Joe need to pay Thea to buy her share of the business? $533,333
   b. What percent of the business will Joe own after he buys Thea’s portion? Round to the nearest tenth of a percent. 41.7%

8. Seventy-two percent of the shareholders in a service corporation are women. If the corporation is owned by 45,600 people, how many of the shareholders are women? 32,832

9. The 120 shareholders of a corporation are voting for a new board of directors. Shareholders receive one vote for each share they own. Would it be possible for one shareholder’s votes to choose the new board of directors? Explain. See margin.

10. The top \( x \) shareholders in a corporation each own \( y \) shares of a certain stock. The corporation’s ownership is represented by a total of \( w \) shares of stock. Express the percent of the corporation owned by the top \( x \) shareholders. \( \frac{100 \times y}{w} \)

TEACH

Fractional Parts

Throughout the applications, students will be examining fractional parts of a whole. They will be using percents primarily, and fractions less frequently.

Percents

Because percents always compare a number to the number 100, it is easier to get an intuitive feel for a percent. For example, if a student scored 17 out of 25 on a quiz, he would likely convert it to a percent to gauge his success.

Exercise 6

Point out to students that if the ratio is 5:12, then Julie owns \( \frac{5}{17} \) of the business.

Exercise 9

Yes, if one person owns more than 50% of the shares.

Exercise 10

Students will frequently need to multiply by 100 to convert decimals to equivalent percents.

ANSWERS

1. Edison is stressing that good ideas are not enough to achieve success. A strong work ethic is also necessary. The word “perspiration” represents the effort required.
11. A corporation is having a shareholders meeting to vote on a new issue. Not all shareholders are able to attend. In fact, most usually do not. The ownership of the corporation is represented by 2,351,000 shares of stock owned by 111,273 shareholders.
   a. Must all of the shareholders own more than one share of stock? **No**
   b. If 3,411 shareholders attend the meeting, what percent of the shareholders attended the meeting? Round to the nearest percent. **3%**
   c. If the shareholders who do not attend own a combined 1.8 million shares of the corporation and the shareholders are voting on a particular issue, these shareholders can vote by proxy—an absentee ballot. If 100,000 of the shareholders vote by proxy, what percent of the shareholders did not vote at all? Round to the nearest percent. **7%**

12. A private corporation owned by 35 shareholders is worth $1.7 million. The corporation loses a lawsuit worth $3 million. What is the value of any personal property of the shareholders that can be taken to pay the settlement? Explain. **See margin.**

13. A partnership owned equally by 13 partners is worth $1.3 million. The partnership loses a lawsuit worth $3 million. What is the value of any personal property each partner must forfeit to pay the settlement? Explain. **See margin.**

14. A sole proprietorship is worth $w$ dollars. The owner loses a lawsuit against him for $y$ dollars, where $y > w$. Express algebraically the value of the personal property the owner must forfeit to pay the settlement. **$y - w$**

15. Six equal partners own a local pizzeria. The partners have made a tremendous profit and bought many personal items such as cars, boats, new homes, and so on. In order to protect their personal possessions, they decide to incorporate the pizzeria, so that the six partners own shares in the corporation and have limited liability. The business is worth $675,000. After an accident, the partners lose a lawsuit and have to pay $1.2 million in damages. How much money will each partner personally lose to pay this lawsuit? Explain. **See margin.**

16. Three people invest in a business. The first two invest in the ratio 2:3, and the third person invests twice as much as the other two combined. The total invested is $30 million.
   a. How much did the major investor contribute? **$20 million**
   b. Does the major investor own more than half the business? **Yes**
   c. What fraction of the business does the major investor own? **$rac{2}{3}$**

17. Ten years ago, Lisa bought a hair salon for $x$ dollars. She built up the business and it is now worth nine times what she paid for it. She decides to sell half of the business to a friend, and they become partners. Express the amount Lisa’s friend must pay Lisa to buy half the business. **$\frac{9x}{2}$**

18. Four people invested in a restaurant. One person invested $100,000. Two others invested in the ratio $x:2x$, and the fourth person invested an amount equal to the other three investors combined. The total investment was $1,100,000.
   a. Write an expression for the amount invested by the fourth person. **$100,000 + 3x$**
   b. Write an equation that allows you to find the amount invested by each person. **$2(100,000 + 3x) = 1,100,000$**
   c. How much did each person invest? **$100,000; 150,000; 300,000; 550,000$**
What Stock Market Data Is Available on a Daily Basis?

The stock market is a general term for an institution through which stocks are bought and sold. Stock market transactions are known as trades. The two most well-known stock markets are the New York Stock Exchange (NYSE) and the National Association of Securities Dealers Automated Quotation System (NASDAQ). A wise investor in stocks makes data-driven decisions by examining short- and long-term trends, changes, fluctuations, and consistencies. Investors intend to profit from their investments. You don’t need to be a professional stockbroker or a financial analyst to follow the market. What you need is an understanding of trading data. This data can be found in newspapers, online, or on television financial channels. The best source for information is the Internet because it is current and accurate within minutes of a market event. However, you want to be certain that you are using a credible source.

In order to interpret stock market data, you need to know the meaning of the categories used in international stock market charts.

- **Last** is the price per share of the last trade of a particular stock. In a newspaper, the last amount is usually the closing price on the last trading day. Online, it is usually the price of the last trade.

- **Open**, or opening price, is the first price at which a share of stock was traded during a regular day’s trading session. For most stock markets across the country, the daily sessions run from 9:30 A.M. to 4:00 P.M. Eastern Time.

---

**EXAMINE THE QUESTION**

To get basic information about volume, trades, and benchmark prices, you can check financial web sites, news websites, television, and newspapers. Obviously, the Internet has a capacity to deliver up-to-the-minute data about the day’s trading.

**CLASS DISCUSSION**

Where have you heard the word “trend” used before? How might trends be important when following the stock market?

What makes an Internet site a credible Internet source? Name credible Internet sources that offer financial information.
Chapter 8  The Stock Market

• **Close**, or *closing price*, is the last price at which a share of a stock was traded during a regular day's trading session.

• **High** is the highest price at which one share of the stock was traded on a given day.

• **Low** is the lowest price at which one share of the stock was traded on a given day.

• **Volume** is the number of shares traded in a given time period. In a newspaper, the volume is usually the day's volume. Online, the volume represents the total number of shares traded within a few minutes of the last trade. Sometimes the volume is listed as *sales in 100s*. This represents the number of groups of 100 shares that were traded on a given day. Some websites may post the exact volume, while other websites state the volume in hundreds, thousands, or even millions.

• **52-week high** is the highest price at which one share was traded over the last year.

• **52-week low** is the lowest price at which one share was traded over the last year.

• **Chg** or *net change* shows the change between the previous day's closing price and the current day's closing price. This can be a monetary amount or it can be expressed as a percentage. The change is positive if the current day's close is greater than the previous day's close and negative if the current day's close is less than the previous day's close.

• **After-hours trading** refers to the trades made after the market closes. A difference between one day's closing price and the next morning's opening price means after-hours trades on that stock occurred.

### Skills and Strategies

Examine the data for XYZ Corp published at the close of two trading days. These categories are used when analyzing data about stock.

<table>
<thead>
<tr>
<th>XYZ Corp</th>
<th>XYZ Corp</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 5</td>
<td>May 12</td>
</tr>
<tr>
<td>Last</td>
<td>Last</td>
</tr>
<tr>
<td>52.20</td>
<td>49.98</td>
</tr>
<tr>
<td>Trade Time</td>
<td>Trade Time</td>
</tr>
<tr>
<td>4:00PM ET</td>
<td>4:00PM ET</td>
</tr>
<tr>
<td>Chg</td>
<td>Chg</td>
</tr>
<tr>
<td>2.61</td>
<td>-1.55</td>
</tr>
<tr>
<td>Open</td>
<td>Open</td>
</tr>
<tr>
<td>50.10</td>
<td>50.60</td>
</tr>
<tr>
<td>52-week High</td>
<td>52-week High</td>
</tr>
<tr>
<td>60.45</td>
<td>60.45</td>
</tr>
<tr>
<td>52-week Low</td>
<td>52-week Low</td>
</tr>
<tr>
<td>40.00</td>
<td>40.00</td>
</tr>
<tr>
<td>Sales in 100s</td>
<td>Sales in 100s</td>
</tr>
<tr>
<td>28000</td>
<td>32000</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>52.60</td>
<td>51.40</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>49.00</td>
<td>49.90</td>
</tr>
</tbody>
</table>

---

**CLASS DISCUSSION**

What is a stock trade?

What data is collected when accounting for the number of trades made in a day?

Why do you think that net change is such an important stock statistic?

---

**TEACH**

As students examine changes in stock prices over time, they use computations involving subtraction and percents to understand the effect of the price changes.
EXAMPLE 1
What was the difference between the high and the low prices on May 5?

**SOLUTION**
The day's high price was $52.60 and the low was $49.00.
Subtract the low from the high.

$52.60 − $49.00 = $3.60

The difference in the high and low prices on May 5 was $3.60.

What was the difference between the high and low prices on May 12?

EXAMPLE 2
On May 12, what was the actual volume of XYZ shares posted? Write the volume in thousands.

**SOLUTION**
The data for May 12 does not use the category name volume. Sales in 100s indicates volume. Because volume in 100s is the number of groups of 100 shares traded, 32,000 hundreds is written

32,000 × 100, or 3,200,000

Sales in 1,000s represents the number of groups of 1,000 shares traded.
Divide by 1,000.

3,200,000 ÷ 1,000 = 3,200

On May 12, there were 3,200 thousands of shares traded.

On May 5, what was the actual volume of XYZ shares posted? Write the volume in thousands.

EXAMPLE 3
At what price did XYZ Corp close on May 4?

**SOLUTION**
XYZ Corp ended the trading day on May 5 with a closing price of $52.20. This reflected a change of $2.61 from the previous day's close. Let \( x \) represent the closing price on May 4. Write an equation for the current day's closing price as the previous day's closing price plus the change.

Substitute values from the chart.

\[ x + 2.61 = 52.20 \]

Subtract 2.61 from each side of the equation.

\[ \frac{-2.61}{x} = 49.59 \]

XYZ Corp closed at $49.59 on May 4. This is different from the May 5 opening amount due to after-hours trading.

At what price did XYZ Corp close on May 11?

**CHECK YOUR UNDERSTANDING**

**Answer** $51.53

Set up and solve the equation \( x - 1.55 = 49.98 \), where \( x \) represents the closing price on May 11.

© 2018 Cengage Learning. All Rights Reserved. This content is not yet final and Cengage Learning does not guarantee this page will contain current material or match the published product.

Not For Sale
EXAMPLE 4

For a percent increase or decrease problem, the numerator is the difference in the before and after amounts. The denominator is the before amount, closing price on May 4. Therefore, this ratio needs to be converted to a percent.

CHECK YOUR UNDERSTANDING

*Answer* –1.8%

EXAMPLE 5

Have students identify the numbers to subtract for the numerator and the number to use in the denominator. Students need to understand that the percent change is a change in the May 5 closing price, so the closing price for May 5 is the denominator of the fraction.

CHECK YOUR UNDERSTANDING

*Answer* –8.5%

EXAMPLE 4

Use the May 4 closing price from Example 3 and the May 5 opening price to find the difference in prices as a percent increase. Round to the nearest hundredth percent.

**SOLUTION** The percent increase of one share of stock for these two prices can be calculated by using the following formula.

\[
\text{Percent increase} = \frac{\text{Open} - \text{Close}}{\text{Close}} \times 100
\]

Substitute values from the chart.

\[
\frac{50.10 - 49.59}{49.59} \times 100
\]

Simplify the fraction.

\[
0.010248 \times 100
\]

Multiply. Then round.

1.03

There was approximately a 1.03% increase in the price per share of XYZ Corp due to after-hours trading.

Use the May 11 closing price from the previous Check Your Understanding and the May 12 opening price to represent the difference as a percent decrease. Round to the nearest hundredth percent.

EXAMPLE 5

On May 6, the XYZ Corp announced a decrease in earnings. This news caused the price of their stock to drop. It closed at $44.37. Express the net change from May 5 to May 6 as a percentage.

**SOLUTION** You can find the net change using the following formula.

\[
\text{Net change} = \frac{\text{May 6 close} - \text{May 5 close}}{\text{May 5 close}} \times 100
\]

Substitute values from the chart.

\[
\frac{44.37 - 52.20}{52.20} \times 100
\]

Simplify the fraction.

\[
-0.15 \times 100
\]

Multiply.

-15%

The net change expressed as a percent is –15%. This means the closing price on May 6 reflects a 15% decrease from the closing price on May 5.

On May 13, the XYZ Corp announced another decrease in earnings. The price of their stock dropped to close at $45.72. Express the net change from May 12 to May 13 as a percentage, to the nearest tenth.
Examine the spreadsheet below that contains information on the XYZ Corp for May 4–6.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>XYZ CORP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Date</td>
<td>High</td>
<td>Low</td>
<td>Close</td>
<td>Change</td>
</tr>
<tr>
<td>4</td>
<td>4-May</td>
<td>50.23</td>
<td>49.34</td>
<td>49.59</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5-May</td>
<td>52.60</td>
<td>49.00</td>
<td>52.20</td>
<td>2.61</td>
</tr>
<tr>
<td>6</td>
<td>6-May</td>
<td>52.20</td>
<td>40.78</td>
<td>44.37</td>
<td></td>
</tr>
</tbody>
</table>

The closing price for May 4 is in cell D4. A formula can be stored in cell E5 to calculate the net change. If E5 represents the net change of the closing price from May 4 to May 5, the equation needed is \( E5 = D5 - D4 \). The cell formula is \( D5 - D4 \). The formula uses the values in cells D5 and D4 to calculate the net change for May 5 and stores it in cell E5.
EXAMPLE 6

Have students identify the cell names that contain the numbers needed to calculate the percent change for May 6. After students have written the formula, discuss the order of operations. Students can then determine why there is a need for parentheses in the formula \( \frac{D6 - D5}{D5} \times 100 \).

As is, the \( D5/D5 \) will be calculated first, which is not what is needed. For the subtraction to be computed, parentheses must first be inserted.

CHECK YOUR UNDERSTANDING

**Answer** for E6: \( =D6-D5 \); for F5: \( =E5/D5 \times 100 \)

Use the change and percent change formulas.

Check Your Understanding

Write a formula for cell F6 to calculate the percent net change for May 6.

**SOLUTION** The percent net change from May 5 to May 6 was calculated in Example 5. The formula uses the May 5 and May 6 closing prices. These prices are in cells D5 and D6, respectively. Use the cell names as the variables, and multiply by 100 to get a percent.

Substitute cell names into formula. \( \frac{D6 - D5}{D5} \times 100 \)

Convert to a spreadsheet formula. \( = (D6 - D5)/D5 \times 100 \)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>XYZ CORP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Date</td>
<td>High</td>
<td>Low</td>
<td>Close</td>
<td>Change</td>
</tr>
<tr>
<td>4</td>
<td>4-May</td>
<td>50.23</td>
<td>49.34</td>
<td>49.59</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5-May</td>
<td>52.60</td>
<td>49.00</td>
<td>52.20</td>
<td>2.61</td>
</tr>
<tr>
<td>6</td>
<td>6-May</td>
<td>52.20</td>
<td>40.78</td>
<td>44.37</td>
<td></td>
</tr>
</tbody>
</table>

Notice there is only one set of parentheses in the formula. Following the order of operations, division by \( D5 \) occurs before multiplication by 100. However, it is necessary to enclose the numerator in parentheses so the difference \( D6 - D5 \) is divided by \( D5 \). Without those parentheses, the spreadsheet first divides \( D5 \) by \( D5 \), then multiplies that quotient by 100, and finally subtracts that answer from \( D6 \), which results in an incorrect value.

You can set the number of rounding places for each cell according to the degree of accuracy needed in your calculations. Be aware that the computer retains the entire calculation to many decimal places. In this case, it just shows the value to two decimal places.
1. Why might the buyer and seller of the same stock both think that their trading price was an "astute" decision? How might those words apply to what you have learned? See margin.

Use the following information posted at the end of the trading day on April 22 to answer Exercises 2–8.

<table>
<thead>
<tr>
<th>52-Week High</th>
<th>52-Week Low</th>
<th>Symbol</th>
<th>Stock</th>
<th>Last</th>
<th>Change</th>
<th>Volume</th>
<th>High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>232,420</td>
<td>198,600</td>
<td>BRK-A</td>
<td>Berkshire Hathaway</td>
<td>199,740</td>
<td>+35</td>
<td>186</td>
<td>198,800</td>
<td>198,700</td>
</tr>
<tr>
<td>51.44</td>
<td>38.06</td>
<td>VZ</td>
<td>Verizon</td>
<td>51.19</td>
<td>+0.04</td>
<td>5,039,967</td>
<td>51.30</td>
<td>50.78</td>
</tr>
<tr>
<td>124.83</td>
<td>87.50</td>
<td>MCD</td>
<td>McDonald's</td>
<td>116.34</td>
<td>−1.13</td>
<td>3,462,877</td>
<td>118.50</td>
<td>115.12</td>
</tr>
<tr>
<td>69.19</td>
<td>47.25</td>
<td>NKE</td>
<td>Nike</td>
<td>62.74</td>
<td>+0.37</td>
<td>5,149,577</td>
<td>63.49</td>
<td>62.58</td>
</tr>
<tr>
<td>52.77</td>
<td>34.61</td>
<td>DAL</td>
<td>Delta Airlines</td>
<td>48.02</td>
<td>−1.18</td>
<td>6,256,770</td>
<td>49.45</td>
<td>47.70</td>
</tr>
<tr>
<td>145.80</td>
<td>102.54</td>
<td>TM</td>
<td>Toyota</td>
<td>105.42</td>
<td>−0.15</td>
<td>174,283</td>
<td>105.98</td>
<td>104.63</td>
</tr>
</tbody>
</table>

2. What was the difference between the 52-week high and 52-week low price for one share of Delta Airlines? $18.16

3. What is the difference between the day's high and low prices for McDonald's Corp? $3.38

4. Rewrite the volume for each of the following stocks as “sales in 100s.”
   a. Berkshire Hathaway Inc. 1.86
   b. McDonald's Corp 34,628.77
   c. Verizon 50,399.67
   d. Toyota 1,742.83

5. Determine the closing price on April 21 for each of the following stocks.
   a. Delta Airlines $49.20
   b. Verizon $51.15

6. Use the information from Exercise 5 to determine the percent of net change from April 21 to April 22 for each of the corporations listed in that question. Round answers to the nearest tenth of a percent. −2.4% for DAL; +0.08% for VZ

7. On April 22, which stock(s) had a 52-week high that was approximately 30% higher than the 52-week low? VZ

8. If the April 23 net change for Toyota was +0.79, what was the closing price for that day? $106.21

9. Which of the following is a true statement? Explain your reasoning.
   The 52-week high can never be higher than the day's high. See margin.
   The day's high can never be higher than the 52-week high. See margin.

9. The 52-week high is the highest price for a stock over a 52-week period. Therefore, the day's high can be equal to the 52-week high, but can never be greater than the 52-week high.
10. At the end of the trading day on April 25, Riveters Inc. closed at $28.84, which was a +5.22% net change from the previous day’s close. What was the approximate close on the previous day? $27.41

11. On February 26, Berkshire Hathaway closed at $197,690 per share. One year earlier, one share closed at $223,970. What was an approximate 1-year percent change? −11.73%

Use the spreadsheet below to answer Exercises 12–16.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Symbol</td>
<td>Stock</td>
<td>February 25</td>
<td>Change</td>
<td>% Change</td>
<td>February 24</td>
<td>Volume in</td>
<td>Volume in</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Close</td>
<td></td>
<td></td>
<td>Close</td>
<td>1000s</td>
<td>100s</td>
</tr>
<tr>
<td>2</td>
<td>AAPL</td>
<td>Apple Inc.</td>
<td>96.76</td>
<td>0.66</td>
<td></td>
<td>96.1</td>
<td>27,393</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>BBW</td>
<td>Build-A-Bear Workshop Inc.</td>
<td>13.98</td>
<td>0.03</td>
<td>0.22%</td>
<td>188</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>CTB</td>
<td>Cooper Tire &amp; Rubber Co.</td>
<td>40.3</td>
<td>1.04</td>
<td></td>
<td>39.26</td>
<td>727</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>F</td>
<td>Ford Motor Co</td>
<td>12.39</td>
<td>0.37</td>
<td></td>
<td>31,951</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>INTC</td>
<td>Intel Corp</td>
<td>28.8</td>
<td></td>
<td>−1.90%</td>
<td>26,432</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>MSF</td>
<td>Microsoft Corp</td>
<td>51.18</td>
<td></td>
<td>−2.80%</td>
<td>26,695</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>NTGR</td>
<td>Netgear Inc.</td>
<td>39.66</td>
<td>0.59</td>
<td>1.50%</td>
<td>228</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>YHOO</td>
<td>Yahoo! Inc.</td>
<td>31.36</td>
<td></td>
<td>1.30%</td>
<td>19,842</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12. Write a formula that will convert the volume given in 1,000s into a volume given in 100s.
   Use the left side of the equation to indicate in which cell to store the formula.
   a. Intel Corp   \( H6=1000*G6/100 \), or \( H6=10*G6 \)
   b. Yahoo! Inc.   \( H9=1000*G9/100 \), or \( H9=10*G9 \)

13. Write a formula that will store the exact volume for each stock in column I.
   Use the left side of the equation to indicate in which cell to store the formula.
   a. Build-A-Bear Workshop Inc.   \( I3=G3*1000 \)
   b. NETGEAR Inc.   \( I8=G8*1000 \)

14. Write a formula to determine the close on February 24 for each of the following. Use the left side of the equation to indicate in which cell to store the formula.
   a. NETGEAR Inc.   \( F8=C8−D8 \)
   b. Ford Motor Co   \( E5=C5−D5 \)

15. Write a formula to determine the percent change for each of the following.
    Use the left side of the equation to indicate in which cell to store the formula.
    a. Apple Inc.   \( E2=(C2−F2)/F2*100 \) or \( E2=D2/F2*100 \)
    b. Cooper Tire & Rubber Co   \( E4=(C4−F4)/F4*100 \) or \( E4=D4/F4*100 \)

16. Write a formula to determine the net change for each. Use the left side of the equation to indicate in which cell to store the formula.
    a. Microsoft Corp   \( D7=C7−F7 \)
    b. Apple Inc.   \( D2=C2−F2 \)
How Can Stock Data Be Displayed?

Stock data can be presented in list form or in graphical form. The graphical form is known as a **stock chart**. These charts offer pictorial information on anything from a day’s worth of data to multiyear data trends. Most stock charts present historical information about the trading prices and volumes of a particular stock.

A common stock chart format is the **stock bar chart**. The chart below shows price and volume information for Johnston Electric on April 30.

Notice the chart consists of two bar graphs. The top graph shows daily information about the day’s high, low, open, and close prices. The bottom graph shows the daily volume for that stock.

The top shaded bar is a rectangle formed by the day’s low and high. The line segment on the left side of the rectangle is positioned at the day’s opening price and the line segment on the right side is positioned at the day’s closing price.

The bottom shaded bar starts at 0 and rises to the approximate number of shares traded on that date. Notice that the scale for this particular portion of the chart is in millions, although it could be in hundreds or thousands depending on the range in the volume. Stock bar charts can also be used to show the market action on multiple days.

**Warm-Up**

An item usually sells for $X$ dollars. It is marked down to $Y$ dollars. Interpret each of the following algebraic expressions in this context.

a. $|Y - X|$

b. $|Y - X|/X$

c. $100(Y - X)/X$

**EXAMINE THE QUESTION**

As students think of the numerous types of data displays they have studied, they will likely come to the conclusion that none are a good fit for stock market data. Thus, there is a need to learn how to create and interpret a new type of data display.

**CLASS DISCUSSION**

Why might an investor be interested in historical information about the trading prices and volumes of a particular stock?
Skills and Strategies

Here you learn how to interpret and create stock charts. The stock bar chart below presents trading information for the week of April 28 for Goldpoint Manufacturing Co.

EXAMPLE 1

Which day had the highest price? Which day had the lowest price?

SOLUTION The top portion of the chart shows the day's trading prices. Because the top of each bar represents the day's high price, the highest high for the week was on May 2. The bottom of each bar represents the day's low price, so the lowest low for the week occurred on April 29.

EXAMPLE 2

Approximately how many shares of Goldpoint Manufacturing Co were traded over the 5-day period?

SOLUTION The bottom graph shows the daily volume of shares traded. The scale is in millions of shares. While it is not possible to give an exact accounting of each day's volume, you can approximate these amounts.

For April 28, the top of the volume bar reaches slightly higher than half the distance between the 150 million and 200 million lines. An approximation of the day's volume is 185 million shares. For April 29, the volume is almost halfway between 50 million and 100 million lines. So an approximation is 70 million shares.

Approximations for the rest of the week's trading volumes are 75 million, 70 million, and 90 million.

Add the five approximations. 185 + 70 + 75 + 70 + 90 = 490

About 490,000,000 shares of Goldpoint Manufacturing Co were traded during the week of April 28.

Between which two days did after-hours trading appear to have the biggest impact on the difference between the closing price and the following day's opening price?

Answer 4/29 and 4/30

Check Your Understanding

You may help students if you distribute graph paper and rulers for this example.

Guide students to realize that a lot of information is available on a stock trend graph. Students can begin to understand the at-a-glance advantage of this type of graph when identifying the greatest high and the least low price for the period of time covered by the graph.

CHECK YOUR UNDERSTANDING

Answer 4/29 and 4/30

Point out that two different units are used in the graph. The bottom portion of the graph charts amounts in millions of shares traded.
EXAMPLE 3

Use the information below to construct a 1-day stock bar chart for Brown Armor Corp.

Open: $40.10 Close: $39.79
High: $40.65 Low: $39.39 Volume: 44,500,000

SOLUTION

Determine an appropriate interval to use to display the information. The range of the daily prices is $39.39 to $40.65. Use interval amounts that are easy to read, such as intervals of $0.25. Then choose a value to begin the interval that is less than the lowest price and a value to end the interval that is greater than the highest price. Use $39.25 to $40.75.

Draw a rectangle whose base is positioned at the low for the day and top at the high for the day. Draw a line to the left of the rectangle that is approximately at the opening price and a line to the right of the rectangle that is approximately at the closing price.

Next construct the volume portion of the chart. Select a suitable interval in millions, in this case 0 to 50. Beginning at 0, construct a bar that rises to the approximate volume for the day. These two graphs form a 1-day stock bar chart.

Suppose that trading was suspended for one entire day for a corporation. What might that stock bar chart look like?
Chapter 8  The Stock Market

Candlestick Charts

Another type of chart that is similar to a stock bar chart is a **candlestick chart**. A candlestick chart may be easier to read and contains more information at a glance. The top and bottom of the vertical line indicate the high and low prices over the given time period. The rectangular region is known as the **real body**. It visually offers the difference between the open and close prices for the trading day. It is displayed in two different colors depending on the action for the day on that stock.

The colors used to indicate the changes in the day’s prices can be customized. The candlestick chart for Sept. 7–11 depicts market action for a particular stock for 5 days in September. The green candlestick indicates that the closing price is greater than the opening price. The red candlestick indicates the opposite; the closing price is less than the opening price.

**EXAMPLE 4**

Explain the difference between the market action on September 8 compared to September 9 shown in the candlestick chart for Sept. 7–11.

**SOLUTION**

The candlestick is green on September 8, which means the closing price for the day was higher than the opening price. The red candlestick on September 9 indicates that the opening price for the day was higher than the closing price.

**EXAMPLE 5**

What was the approximate difference between the highest price and the lowest price for the week shown in the candlestick chart for Sept. 7–11?

**SOLUTION**

The highest price for the week, approximately $39.90, occurred on September 7, as indicated by the highest portion of any of the candlesticks. The lowest price for the week, approximately $37.75, occurred on September 11, as indicated by the lowest portion of any of the candlesticks. The difference between the week’s high and low prices is approximately $39.90 – $37.75, or $2.15.

**Check Your Understanding**

Interpret a green candlestick that is shown as only a rectangle with no lines at the top or bottom.

**Check Your Understanding**

Have students identify the highs and lows for each of the days.

**Check Your Understanding**

The lengths of the candlesticks for September 8 and 11 are approximately the same.

What does this mean about the trading prices on both of those days?
Applications

1. How might those words apply to what you have learned? Why is the author warning readers that a share is not a lottery ticket?

The following stock bar chart depicts the market action for the Washington Petroleum Corp during the week of April 28. Use the chart to answer Exercises 2–11.

2. On what date did the stock close at a price higher than it opened?
3. What was the day’s opening price on the following days?
   - April 28: Approx. 690
   - April 29: Approx. 679
   - April 30: Approx. 666
   - May 1: Approx. 651
   - May 2: Approx. 660
4. What was the day’s high price on April 29? $680
5. What was the day’s low price on May 1? $650
6. What was the day’s close on May 2? Approx. $653
7. What was the approximate net change from April 29 to April 30? Express that net change as a monetary amount and as a percent to the nearest tenth. $10; –1.5%
8. What was the approximate net change from April 30 to May 1? Express that net change as a monetary amount and as a percent to the nearest tenth. $29; 4.4%
9. Approximately how many shares were traded on April 30? 40,000 shares
10. Approximately how many fewer shares were traded on April 28 than on May 2? 31,000 shares

ANSWERS

1. The writer indicates that playing the market is not a game. It is not a quick way to make money like a lottery. Rather, it is a way to invest in a corporation by becoming part owner of the business.

TEACH
Exercises 2–12
When reviewing these problems, you should project the graphs for the entire class. Have students come to the front of the room to identify the locations that indicate the correct answers to the questions.
11. Suppose that the volume numbers had been listed in hundreds on the table. How would that have changed the labels? 0, 200, 400, 600

12. Use the following data to construct a stock bar chart for the 5-day period.

<table>
<thead>
<tr>
<th>Day</th>
<th>Open</th>
<th>Close</th>
<th>High</th>
<th>Low</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20.48</td>
<td>20.24</td>
<td>20.50</td>
<td>20.20</td>
<td>58,000,000</td>
</tr>
<tr>
<td>2</td>
<td>20.21</td>
<td>20.25</td>
<td>20.30</td>
<td>20.00</td>
<td>52,000,000</td>
</tr>
<tr>
<td>3</td>
<td>20.30</td>
<td>20.10</td>
<td>20.34</td>
<td>20.02</td>
<td>42,000,000</td>
</tr>
<tr>
<td>4</td>
<td>20.17</td>
<td>20.44</td>
<td>20.45</td>
<td>20.10</td>
<td>50,000,000</td>
</tr>
<tr>
<td>5</td>
<td>20.48</td>
<td>20.61</td>
<td>20.65</td>
<td>20.36</td>
<td>50,000,000</td>
</tr>
</tbody>
</table>

13. Use the following data to construct a stock bar chart for the 5-day period.

<table>
<thead>
<tr>
<th>Day</th>
<th>Open</th>
<th>Close</th>
<th>High</th>
<th>Low</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>59.75</td>
<td>59.60</td>
<td>60.00</td>
<td>59.22</td>
<td>7,900,000</td>
</tr>
<tr>
<td>2</td>
<td>59.15</td>
<td>60.20</td>
<td>60.50</td>
<td>59.15</td>
<td>8,000,000</td>
</tr>
<tr>
<td>3</td>
<td>60.00</td>
<td>59.58</td>
<td>60.61</td>
<td>59.55</td>
<td>8,200,000</td>
</tr>
<tr>
<td>4</td>
<td>59.55</td>
<td>60.90</td>
<td>60.90</td>
<td>59.37</td>
<td>7,000,000</td>
</tr>
<tr>
<td>5</td>
<td>60.87</td>
<td>60.93</td>
<td>61.25</td>
<td>60.79</td>
<td>7,750,000</td>
</tr>
</tbody>
</table>

14. Use the candlestick chart to answer the questions.
   a. On which days were opening prices higher than the closing prices? 4/28, 4/30
   b. On which days were the closing prices higher than the opening prices? 4/27, 4/29, 5/1
   c. What was the approximate closing price on April 28? $32.45
   d. What was the approximate high price on May 1? $33.45
   e. What was the difference between the lowest price and the highest price recorded for this time period? $1.50
   f. What does the very short line at the bottom of the May 1 candlestick indicate? See margin.
   g. Had the chart used white and black candlesticks, which days would be white and which days would be black? white: 4/27, 4/29, 5/1; black: 4/28, 4/30
   h. On which consecutive days was the closing price of the first day higher than the opening price of the second day? 4/28 and 4/29; 4/30 and 5/1

15. Construct a candlestick chart for the data presented in Exercise 12.
8-4 Trends in Stock Closing Prices

Never try to walk across a river just because it has an average depth of four feet.
—Milton Friedman, American economist

Objectives
- Explain how data is smoothed.
- Calculate simple moving averages using the arithmetic average formula.
- Calculate simple moving averages using the subtraction and addition method.
- Graph simple moving averages using a spreadsheet.

Key Terms
- smoothing techniques
- simple moving average (SMA)
- lagging indicators
- fast-moving average
- slow-moving average
- crossover

Warm-Up
Given $A > B > C > D$, which of the following has the greatest value?
Explain your reasoning.
1. The average of $A$, $B$, $C$, and $D$
2. The sum of $A$, $B$, $C$, and $D$
3. The difference between $A$ and $D$

The sum will yield a greater value than $A$, $B$, $C$, or $D$. The average and the difference have to be less than the greatest of the four numbers.

Can Historical Stock Market Data Inform Future Trends?

Stock market prices can fluctuate greatly from trade to trade based on a variety of external factors. You have already seen that the high and low for a day may not necessarily be near the day’s opening or closing prices. Those differences often make it difficult to spot trends over time. In this section, you will learn two techniques that will give you insight into analyzing historical stock market closing prices. The first technique will answer the question “How can stock data be smoothed?” The second will answer the question “How do peaks and valleys in closing prices assist in making buy/sell predictions?”

Simple Moving Averages

Statistical tools that allow an investor to reduce the impact of price fluctuations and to focus on patterns and trends are referred to as smoothing techniques. One such technique is known as a simple moving average (SMA). Simple moving averages are calculated by determining the mean (arithmetic average) closing prices over a given period of time.

The graph shows the daily stock closing prices, 5-day SMA, and 10-day SMA over a period of 30 trading days. Notice how the closing prices fluctuated from day to day and the moving average graphs smoothed out that data. The longer the moving average time interval, the smoother the graph appears to be.

Moving averages are known as lagging indicators because they use past data. Investors use simple moving averages when they want to identify and follow a trend in prices.
Skills and Strategies

Recall that the mean, or arithmetic average, of a set of numerical data is the sum of the items in that set divided by the number of items. You can determine the average of any number of closing prices, but this gives you little information about trends because you would have nothing to compare the averages to. A better comparison method to use is a simple moving average.

Simple Moving Averages Using the Arithmetic Average Formula

Although simple moving averages can span any length of time, in Example 1 you will find averages by taking closing prices 5 days at a time: days 1–5, days 2–6, days 3–7, days 4–8, days 5–9, and days 6–10. These are known as the 5-day simple moving averages, or the 5-day SMA. You will then graph the six averages. The graph will have a smoother appearance compared to the graph of the closing prices of days 5–10. A moving average graph "smooths" the fluctuations in closing prices to make trends easier to see.

EXAMPLE 1

The closing prices for 10 consecutive trading days for a particular stock are shown. Calculate the 5-day SMA and plot both the closing prices and the averages on a graph.

SOLUTION

Find the average of the closing prices in groups of five.

Find the SMA using the closing prices from days 1–5.

\[
\frac{35.02 + 35.01 + 34.65 + 36.09 + 35.32}{5} = \frac{175.1}{5} = 35.02\approx 35.22
\]

Days 2–6

\[
\frac{35.01 + 34.65 + 36.09 + 35.32 + 35.50}{5} = \frac{176.8}{5} = 35.31\approx 35.31
\]

Days 3–7

\[
\frac{34.65 + 36.09 + 35.32 + 35.50 + 35.03}{5} = \frac{176.6}{5} = 35.318\approx 35.32
\]

Days 4–8

\[
\frac{36.09 + 35.32 + 35.50 + 35.03 + 35.79}{5} = \frac{177.2}{5} = 35.44\approx 35.55
\]

Days 5–9

\[
\frac{35.32 + 35.50 + 35.03 + 37.07 + 35.79}{5} = \frac{176.1}{5} = 35.22\approx 35.74
\]

Days 6–10

\[
\frac{35.50 + 35.03 + 37.07 + 36.05}{5} = \frac{173.6}{5} = 34.72\approx 35.89
\]

The five consecutive 5-day SMA are $35.22, $35.31, $35.55, $35.74, and $35.89. The graph of the closing prices and the simple moving averages for days 5–10 are shown. Notice how the moving averages smooth out the graph.
Simple Moving Averages Using the Subtraction and Addition Method

The calculation of a simple moving average can be tedious because you have to find the average for each time interval. There is an alternate way to compute the moving average that is simpler.

Suppose you want to determine a 3-day simple moving average for 6 trading days. Let the trading prices for the days be represented by $A$, $B$, $C$, $D$, $E$, and $F$. The trading prices for the first three days are $A$, $B$, and $C$. The average of those prices is

$$\frac{A + B + C}{3}$$

Using the method in Example 1, find the average of days 2–4 using $B$, $C$, and $D$. This is the same as subtracting price $A$ and adding price $D$, or

$$\frac{A}{3} + \frac{B}{3} + \frac{C}{3} - \frac{A}{3} + \frac{D}{3}$$

Rearranging the terms and simplifying, this process is the same as finding the average for days 2–4.

$$\frac{A}{3} - \frac{A}{3} + \frac{B}{3} + \frac{C}{3} + \frac{D}{3} = \frac{B}{3} + \frac{C}{3} + \frac{D}{3} = \frac{B + C + D}{3}$$

EXAMPLE 2

Use the subtraction and addition method to determine the 4-day SMA for the following closing prices.

$121, \$122, \$120, \$119, \$124, \$128, \$126$

SOLUTION

Calculate the average closing prices of days 1–4.

Add the first four prices. Divide by 4.

$$\frac{121 + 122 + 120 + 119}{4} = 120.50.$$  

Use subtraction and addition to determine the averages for days 2–5.

Use previous average, $\frac{121}{4}$, and $\frac{124}{4}$

$$120.50 - \frac{121}{4} + \frac{124}{4} = 121.25$$

Find the averages for days 3–6 and days 4–7.

Use previous average, $\frac{122}{4}$, and $\frac{128}{4}$

$$121.25 - \frac{122}{4} + \frac{128}{4} = 122.75$$

Use previous average, $\frac{120}{4}$, and $\frac{126}{4}$

$$122.75 - \frac{120}{4} + \frac{126}{4} = 124.25$$

The simple moving averages are $120.50, 121.25, 122.75,$ and $124.25$.

Check Your Understanding

Use the subtraction and addition method to determine the 3-day SMA for the closing prices $28, \$31, \$37, \$38,$ and $35$.

Extend Your Understanding

In Example 2, what would the eighth trading day’s closing price have to be so that the next moving average remains the same at $124.25$?
Graph Simple Moving Averages Using a Spreadsheet

Simple moving averages are more informative when they are determined over a longer period of time. Often, financial websites and newspapers report long moving average time intervals. These calculations are time-consuming if done by hand or even using a calculator. However, if you use a spreadsheet you can get results easily and quickly. The spreadsheet shown lists the closing prices of 30 consecutive days of trading for a particular stock. The 10-day moving averages are calculated in column C and begin on day 10. Cell C11 equals the average of the closing prices on days 1–10.

Spreadsheets have a sum function, which is used to calculate the sum of amounts in a group of cells. The format for using a sum function varies depending on the spreadsheet software you are using. The format used here is \( \text{sum(starting cell:ending cell)} \). The formula in cell C11 that yields the correct average is \( \frac{\text{sum(B2:B11)}}{10} \). The cells have been formatted to show all decimals rounded to two places.

The formula in cell C12 is \( \frac{\text{sum(B3:B12)}}{10} \). Notice that the starting and ending cells in the formula have each shifted down by one cell. Rather than typing this formula repeatedly and changing the cell names used, most spreadsheets have a fill command that recognizes the pattern. To use this command in this spreadsheet, select the cell with the formula you want to copy, and then choose the appropriate fill command and drag through the cells that you want to fill with the formula. Most spreadsheets allow the user to fill up, fill down, fill left, or fill right. In this case, you fill down. The formula is placed in each selected cell with the cell names automatically adjusted for each row.

### Example 3

Use a spreadsheet to calculate the 5-day SMA of the closing prices for these 10 consecutive trading days.

Apr 28: $29.39  Apr 29: $29.27  Apr 30: $29.21  May 1: $29.70  May 2: $29.08

**Solution**

List the days in column A, the closing prices in column B, and calculate the moving averages in column C. Moving averages lag behind the closing prices, so in cell C6 calculate the average of the closing prices for April 28, 29, 30, May 1 and 2. The formula is \( \frac{\text{sum(B2:B6)}}{5} \). Next, highlight cells C6–C11 and apply the fill-down command to have the 5-day moving averages appear in the appropriate cells as shown in blue.

**Check Your Understanding**

Add column D to the Example 3 spreadsheet to calculate the 3-day SMA. In what cell do you start? What formula do you use?
Crossovers
Sometimes, investors construct stock charts that depict moving averages for two different intervals. The graph with the shorter time interval is known as the fast-moving average and the graph with the longer time interval is known as the slow-moving average. As changes in closing prices occur on a day-to-day basis, the fast-moving average will reflect those changes quicker than the slow-moving average will.

A crossover occurs when one time interval moving average graph overtakes another. Crossovers signal that a stock trend reversal might be near. Some say that an investor should consider buying when the fast-moving average graph overtakes (rises above) the slow-moving average graph. Likewise, an investor might consider selling when the fast-moving average graph crosses below the slow-moving average graph.

EXAMPLE 4
The graph shows the closing prices for 29 consecutive trading days. It also charts the 7-day and 21-day simple moving averages. What signal might the graphs give an investor?

SOLUTION A crossover occurs on the 27th day. The fast moving average graph rises above the slow moving average graph giving a signal to consider buying the stock.

Suppose that on the 35th trading day, the 21-day SMA graph rises above the 7-day graph. What might that indicate?

Regression Analysis
As you have seen in previous sections, regression analysis can be used to see if there is a correlation between two sets of data. Financial analysts use a variety of regression techniques to look for trends in stock prices. Many of the methods apply complicated formulas and procedures to produce graphs that allow analysts to make data-driven predictions on where a stock may be headed. They might then decide to buy or sell a stock based on the information from the regression lines and curves. In Examples 1–4, you found simple moving averages that allowed you to smooth the data in order to get a clearer picture of trends. In the examples that follow, you will do the same using the statistical and graphing features of a calculator, software, or spreadsheet.
EXAMPLE 5

Make sure that students check the data for correctness. Even a single wrong digit can change the regression equation.

“There is a typographical error in the student edition of this chart. The entry for 2/9 should read $36.65. Please inform your students of this change so that the answers for Examples 5 and 6 match those in the text.”

Examine the 36 consecutive trading day closing prices of ZZB.

<table>
<thead>
<tr>
<th>DATE</th>
<th>CLOSE</th>
<th>DATE</th>
<th>CLOSE</th>
<th>DATE</th>
<th>CLOSE</th>
<th>DATE</th>
<th>CLOSE</th>
<th>DATE</th>
<th>CLOSE</th>
<th>DATE</th>
<th>CLOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/6</td>
<td>34.00</td>
<td>1/14</td>
<td>34.30</td>
<td>1/25</td>
<td>35.00</td>
<td>2/2</td>
<td>36.06</td>
<td>2/10</td>
<td>36.43</td>
<td>2/19</td>
<td>36.57</td>
</tr>
<tr>
<td>1/7</td>
<td>33.51</td>
<td>1/15</td>
<td>33.99</td>
<td>1/26</td>
<td>35.40</td>
<td>2/3</td>
<td>36.72</td>
<td>2/11</td>
<td>36.21</td>
<td>2/22</td>
<td>36.86</td>
</tr>
<tr>
<td>1/8</td>
<td>33.54</td>
<td>1/19</td>
<td>34.51</td>
<td>1/27</td>
<td>35.48</td>
<td>2/4</td>
<td>36.53</td>
<td>2/12</td>
<td>36.47</td>
<td>2/23</td>
<td>36.74</td>
</tr>
<tr>
<td>1/11</td>
<td>33.95</td>
<td>1/20</td>
<td>33.90</td>
<td>1/28</td>
<td>35.53</td>
<td>2/5</td>
<td>36.88</td>
<td>2/16</td>
<td>36.65</td>
<td>2/24</td>
<td>37.10</td>
</tr>
<tr>
<td>1/12</td>
<td>33.90</td>
<td>1/21</td>
<td>34.54</td>
<td>1/29</td>
<td>36.06</td>
<td>2/8</td>
<td>37.11</td>
<td>2/17</td>
<td>36.64</td>
<td>2/25</td>
<td>37.37</td>
</tr>
<tr>
<td>1/13</td>
<td>33.74</td>
<td>1/22</td>
<td>35.14</td>
<td>2/1</td>
<td>36.18</td>
<td>2/9</td>
<td>36.65</td>
<td>2/18</td>
<td>36.99</td>
<td>2/26</td>
<td>37.13</td>
</tr>
</tbody>
</table>

The chart covers the trading days from January 6 to February 26. Construct a scatter plot and find a regression line and the correlation coefficient. Use the equation to predict the closing price on the 37th trading day of ZZB.

SOLUTION

Using a graphing calculator, graphing software, online graphing websites, or a spreadsheet, you can generate the following scatterplot. Starting with 1/6 as day 1, 1/7 as day 2, and so on, use the ordered pairs (1, 34), (2, 33.51), . . . in the form (day number, closing price) to construct a scatter plot.

The regression line is determined using the ordered pairs in the chart. This line has a positive slope, indicating an increasing price trend. The correlation coefficient is a strong 0.94.
To use the linear regression equation to make a prediction for the closing price on the 37th day, substitute $x = 37$ into the equation $y = 0.1123x + 33.583$ and round the answer to the nearest penny.

$$y = 0.1123(37) + 33.583$$

$$y = 37.74$$

The predicted closing price for the 37th trading day is $37.74.

What closing price might be predicted for the 38th trading day?

EXAMPLE 6

Use the data from Example 5. As we have seen previously, sometimes you can get a better regression function by using polynomials. Determine quadratic, cubic, and quartic regression equations. Make a prediction for the closing price on the 37th day using each.

**SOLUTION** The three graphs are pictured here.

Quadratic regression curve and equation

$$y = -0.0026x^2 + 0.208x + 32.976$$

Cubic regression curve and equation

$$y = -.00014x^3 + .0051x^2 + .09212x + 33.358$$
Quartic regression curve and equation

\[ y = 0.000028x^4 - 0.0022x^3 + 0.0547x^2 - 0.3289x + 34.223 \]

Notice the similarities and differences between and among the linear, quadratic, cubic, and quartic equation graphs. The linear shows a strict increasing trend. Although the quadratic is increasing it appears to be tapering off in the last few trading days. The cubic equation increases at first but then turns downward. Finally, the quartic shows more of the hills and valleys in the trading prices but appears to indicate a continued increase in the trading prices as the days go on.

Keep in mind that the coefficients and constants in the equations have been rounded. The predicted closing prices using the 4 regression equations are as follows:

- Linear: $37.74
- Quadratic: $37.11
- Cubic: $36.66
- Quartic: $37.98

As you can see, using regression analysis as a stock price prediction tool is not an exact science. That is why analysts use multiple prediction methods before making large and expensive trades.

**CHECK YOUR UNDERSTANDING**

In each equation, the first term has the greatest effect, since the \( x \) value is being raised to the highest power. Reducing the accuracy of the coefficient of that first term will have the greatest impact on the answer.

Cubic: $38.68; Quartic: $22.98

In the cubic and quartic equations, the rounding of the coefficients of the terms with the highest degree has a significant impact on the predicted value. Calculate the predicted closing prices on the 37th day had the coefficient of the highest-degree cubic term been \(-0.0001\) and the highest-degree quartic term been \(0.0002\). Why do you think there is a difference?
1. Why might the author be warning readers to be cautious of averages? How might these words apply to what you have learned?

In Exercises 2–5, use the method illustrated in Example 1 to determine the simple moving averages by repeatedly finding sums.

2. Determine the 3-day SMA for the 10-consecutive-day closing prices of Angie's List Inc. listed below.
   $7.78 $8.08 $7.99 $8.02 $7.89 $8.72 $9.19 $9.16 $8.98 $9.38

3. Determine the 5-day SMA for the 10-consecutive-day closing prices for Sherwin-Williams Co listed below.
   $242.50 $273.98 $278.16 $293.94 $285.04 $290.80 $296.02 $291.01 $293.41 $286.85

4. Determine the 4-day SMA for the 10-consecutive-day closing prices for Wal-Mart Stores Inc. listed below.
   $57.35 $58.61 $57.98 $58.07 $57.50 $56.97 $56.35 $57.16 $57.18

5. Determine the 6-day SMA for the 12-consecutive-day closing prices for ExxonMobil Corp listed below.
   $92.60 $92.46 $92.45 $91.79 $93.07 $89.61 $89.70

In Exercises 6–9, use the method illustrated in Example 2 to determine moving averages by subtraction and addition.

6. Determine the 2-day SMA for the 10-consecutive-day closing prices for Western Digital Corp listed below.
   $101.96 $101.80 $101.50 $103.07 $104.94 $105.12 $105.66 $104.76 $100.56 $101.31

7. Determine the 3-day SMA for the 10-consecutive-day closing prices for Procter & Gamble Co listed below.
   $66.21 $65.90 $67.05 $67.03 $66.80 $66.65 $66.65 $65.80 $65.92 $65.21

8. Determine the 4-day SMA for the 10-consecutive-trading-day closing prices for Toyota Motor Corp listed below.
   $121.69 $122.85 $120.70 $123.61 $123.18 $122.03 $122.82 $124.14 $124.92 $124.06

9. Determine the 6-day SMA for the 10-consecutive-trading-day closing prices for SunEdison Inc listed below.
   $2.65 $2.63 $2.70 $2.63 $2.50 $2.65 $2.66 $2.56 $2.52 $2.37
10. Use a spreadsheet to determine the 7-day SMA. See additional answers.

<table>
<thead>
<tr>
<th>Date</th>
<th>Closing Price</th>
<th>3-Day SMA</th>
<th>10-Day SMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-Apr</td>
<td>24.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8-Apr</td>
<td>23.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-Apr</td>
<td>23.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-Apr</td>
<td>23.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-Apr</td>
<td>23.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-Apr</td>
<td>24.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13-Apr</td>
<td>23.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14-Apr</td>
<td>22.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-Apr</td>
<td>22.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-Apr</td>
<td>22.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17-Apr</td>
<td>22.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-Apr</td>
<td>22.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19-Apr</td>
<td>22.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-Apr</td>
<td>22.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-Apr</td>
<td>22.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22-Apr</td>
<td>22.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23-Apr</td>
<td>22.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24-Apr</td>
<td>22.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-Apr</td>
<td>22.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26-Apr</td>
<td>22.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27-Apr</td>
<td>22.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28-Apr</td>
<td>22.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29-Apr</td>
<td>22.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-Apr</td>
<td>22.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-May</td>
<td>25.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-May</td>
<td>25.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-May</td>
<td>25.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-May</td>
<td>25.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-May</td>
<td>25.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-May</td>
<td>25.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7-May</td>
<td>25.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8-May</td>
<td>25.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-May</td>
<td>25.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-May</td>
<td>25.99</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11. Use a spreadsheet to determine the 10-day SMA. See additional answers.

<table>
<thead>
<tr>
<th>Date</th>
<th>Closing Price</th>
<th>3-Day SMA</th>
<th>10-Day SMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Mar</td>
<td>19.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-Mar</td>
<td>20.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-Mar</td>
<td>19.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-Mar</td>
<td>20.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-Mar</td>
<td>19.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-Mar</td>
<td>19.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7-Mar</td>
<td>19.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8-Mar</td>
<td>18.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-Mar</td>
<td>18.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-Mar</td>
<td>18.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-Mar</td>
<td>18.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-Mar</td>
<td>18.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13-Mar</td>
<td>19.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14-Mar</td>
<td>18.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-Mar</td>
<td>18.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-Mar</td>
<td>19.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17-Mar</td>
<td>20.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-Mar</td>
<td>20.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19-Mar</td>
<td>20.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-Mar</td>
<td>20.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-Mar</td>
<td>20.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22-Mar</td>
<td>20.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23-Mar</td>
<td>20.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24-Mar</td>
<td>20.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-Mar</td>
<td>20.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26-Mar</td>
<td>20.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27-Mar</td>
<td>20.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28-Mar</td>
<td>20.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29-Mar</td>
<td>20.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-Mar</td>
<td>20.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31-Mar</td>
<td>20.12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12. Use a spreadsheet to determine the 2-day, 3-day, and 5-day SMA.

<table>
<thead>
<tr>
<th>Date</th>
<th>Closing Price</th>
<th>3-Day SMA</th>
<th>5-Day SMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Mar</td>
<td>440.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-Mar</td>
<td>465.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-Mar</td>
<td>465.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-Mar</td>
<td>455.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-Mar</td>
<td>471.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-Mar</td>
<td>476.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7-Mar</td>
<td>447.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8-Mar</td>
<td>467.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-Mar</td>
<td>464.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-Mar</td>
<td>457.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-Mar</td>
<td>451.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-Mar</td>
<td>446.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13-Mar</td>
<td>455.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14-Mar</td>
<td>453.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-Mar</td>
<td>454.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-Mar</td>
<td>459.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17-Mar</td>
<td>449.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-Mar</td>
<td>437.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19-Mar</td>
<td>455.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-Mar</td>
<td>455.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-Mar</td>
<td>455.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22-Mar</td>
<td>455.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23-Mar</td>
<td>455.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24-Mar</td>
<td>455.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-Mar</td>
<td>455.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26-Mar</td>
<td>455.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27-Mar</td>
<td>455.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28-Mar</td>
<td>455.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29-Mar</td>
<td>455.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-Mar</td>
<td>455.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31-Mar</td>
<td>455.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13. The stock chart shows the 3-day and 10-day SMA for 20 consecutive trading days. Identify the crossovers and discuss the implications. See additional answers.

14. The stock chart shows the 3-day, 5-day, and 10-day SMA for 16 consecutive trading days of Facebook Inc. stock. Examine the crossovers between the 9th and the 12th days. Discuss the implications. See additional answers.
15. Use a spreadsheet to calculate the 2-day and 5-day SMA for ten consecutive-day closing prices of the corporation shown in the chart below. Graph the closing prices and averages.  

See additional answers.

<table>
<thead>
<tr>
<th>DATE</th>
<th>CLOSING PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-Apr</td>
<td>28.55</td>
</tr>
<tr>
<td>22-Apr</td>
<td>28.54</td>
</tr>
<tr>
<td>23-Apr</td>
<td>28.08</td>
</tr>
<tr>
<td>24-Apr</td>
<td>27.30</td>
</tr>
<tr>
<td>25-Apr</td>
<td>26.80</td>
</tr>
<tr>
<td>28-Apr</td>
<td>26.43</td>
</tr>
<tr>
<td>29-Apr</td>
<td>27.36</td>
</tr>
<tr>
<td>30-Apr</td>
<td>27.41</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE</th>
<th>CLOSING PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-May</td>
<td>26.81</td>
</tr>
<tr>
<td>2-May</td>
<td>28.67</td>
</tr>
<tr>
<td>3-May</td>
<td>24.37</td>
</tr>
<tr>
<td>4-May</td>
<td>25.72</td>
</tr>
<tr>
<td>5-May</td>
<td>25.64</td>
</tr>
<tr>
<td>6-May</td>
<td>26.22</td>
</tr>
<tr>
<td>7-May</td>
<td>25.93</td>
</tr>
<tr>
<td>8-May</td>
<td>26.43</td>
</tr>
<tr>
<td>9-May</td>
<td>27.36</td>
</tr>
</tbody>
</table>

16. Use the following 25 consecutive days’ closing prices for Apple Inc. to determine linear, quadratic, cubic, and quartic regression equations. What trends do you see? What are the predictions for the closing price on the 26th trading day? Starting with 1/22 as day 1, 1/25 as day 2, etc., use the ordered pairs (1, 100.87), (2, 98.90) . . . in the form (day number, closing price).  

See Additional Answers.

<table>
<thead>
<tr>
<th>DATE</th>
<th>CLOSING PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/22</td>
<td>100.87</td>
</tr>
<tr>
<td>1/25</td>
<td>98.90</td>
</tr>
<tr>
<td>1/26</td>
<td>99.45</td>
</tr>
<tr>
<td>1/27</td>
<td>92.92</td>
</tr>
<tr>
<td>1/28</td>
<td>93.58</td>
</tr>
<tr>
<td>1/29</td>
<td>96.81</td>
</tr>
<tr>
<td>2/1</td>
<td>95.91</td>
</tr>
<tr>
<td>2/2</td>
<td>93.97</td>
</tr>
<tr>
<td>2/3</td>
<td>95.83</td>
</tr>
<tr>
<td>2/4</td>
<td>96.60</td>
</tr>
<tr>
<td>2/5</td>
<td>94.02</td>
</tr>
<tr>
<td>2/8</td>
<td>95.01</td>
</tr>
<tr>
<td>2/9</td>
<td>94.99</td>
</tr>
<tr>
<td>2/10</td>
<td>94.27</td>
</tr>
<tr>
<td>2/11</td>
<td>93.70</td>
</tr>
<tr>
<td>2/12</td>
<td>93.99</td>
</tr>
<tr>
<td>2/16</td>
<td>96.64</td>
</tr>
<tr>
<td>2/17</td>
<td>98.12</td>
</tr>
<tr>
<td>2/18</td>
<td>96.26</td>
</tr>
<tr>
<td>2/19</td>
<td>96.04</td>
</tr>
<tr>
<td>2/22</td>
<td>96.88</td>
</tr>
<tr>
<td>2/23</td>
<td>94.69</td>
</tr>
<tr>
<td>2/24</td>
<td>96.10</td>
</tr>
<tr>
<td>2/25</td>
<td>96.76</td>
</tr>
<tr>
<td>2/26</td>
<td>96.91</td>
</tr>
</tbody>
</table>

17. Use the following 25 consecutive days’ closing prices for Target Corp to determine linear, quadratic, cubic, and quartic regression equations. What trends do you see? What are the predictions for the closing price on the 26th trading day? Starting with 1/22 as day 1, 1/25 as day 2, etc., use the ordered pairs (1, 69.15), (2, 68.35) . . . in the form (day number, closing price).  

See Additional Answers.

<table>
<thead>
<tr>
<th>DATE</th>
<th>CLOSING PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/22</td>
<td>69.15</td>
</tr>
<tr>
<td>1/25</td>
<td>68.35</td>
</tr>
<tr>
<td>1/26</td>
<td>69.86</td>
</tr>
<tr>
<td>1/27</td>
<td>70.11</td>
</tr>
<tr>
<td>1/28</td>
<td>70.41</td>
</tr>
<tr>
<td>1/29</td>
<td>71.82</td>
</tr>
<tr>
<td>2/1</td>
<td>72.23</td>
</tr>
<tr>
<td>2/2</td>
<td>72.71</td>
</tr>
<tr>
<td>2/3</td>
<td>71.97</td>
</tr>
<tr>
<td>2/4</td>
<td>69.46</td>
</tr>
<tr>
<td>2/5</td>
<td>68.99</td>
</tr>
<tr>
<td>2/8</td>
<td>69.42</td>
</tr>
<tr>
<td>2/9</td>
<td>69.29</td>
</tr>
<tr>
<td>2/10</td>
<td>68.19</td>
</tr>
<tr>
<td>2/11</td>
<td>67.49</td>
</tr>
<tr>
<td>2/12</td>
<td>69.95</td>
</tr>
<tr>
<td>2/16</td>
<td>71.50</td>
</tr>
<tr>
<td>2/17</td>
<td>72.10</td>
</tr>
<tr>
<td>2/18</td>
<td>72.53</td>
</tr>
<tr>
<td>2/19</td>
<td>72.32</td>
</tr>
<tr>
<td>2/22</td>
<td>72.47</td>
</tr>
<tr>
<td>2/23</td>
<td>73.99</td>
</tr>
<tr>
<td>2/24</td>
<td>76.94</td>
</tr>
<tr>
<td>2/25</td>
<td>78.67</td>
</tr>
<tr>
<td>2/26</td>
<td>78.43</td>
</tr>
</tbody>
</table>
Chapter 8
The Stock Market

Warm-Up
Let \( C \) be the number of calls per minute, let \( M \) be the number of minutes, and let \( T \) be the total number of calls.

a. What does \( CM \) represent?

b. What does \( \frac{T}{C} \) represent?

Objectives

- Explain stock market ticker information.
- Determine the total value of a trade from ticker information.
- Determine trade volumes from ticker information.

Key Terms

Dow Jones Industrial Average (DJIA)
ticker

The average trade of an individual is in the thousands of shares, whereas the institutional trade can be in the millions of shares. Clearly, the bigger the order, the bigger the move in the stock.

—Maria Bartiromo, business news anchor

How is Stock Market Data Transmitted to the Investor?

Investors are always interested in how the market is doing. You can refer to a variety of published information systems to track the performance of certain types of stocks. Perhaps the most well known of these systems is the Dow Jones Industrial Average (DJIA), also known as the Dow. The Dow follows the daily trading action of 30 large public companies. Historically, these were industrial companies, but the corporations included in the Dow have grown to include those in telecommunications, pharmaceuticals, broadcasting, retail, insurance, and more. The Dow is a well-respected average that offers a broad picture of how the market is performing from day to day.

Investors wanting specific information often turn to another source. One of the first stock information transmission machines was invented by Thomas Edison in 1869. It was known as the Universal Stock Ticker and had a printing speed of about one character per second. The machine was known as a ticker because of the ticking sound that it made as printed tape came out of it. This ticker tape machine replaced the need for handwritten and hand-delivered messages about stock trades. Stock tickers in different buildings were connected by telegraph machines. The printed tape would contain a ticker symbol that was unique to a given company. Once the company was identified by the symbol, the ticker would print information about the number of shares traded, the price of that trade, and any change in the direction of the price of a share of the

EXAMINE THE QUESTION

For traders that want basic stock market data in a timely manner, the stock ticker is available. If you have seen financial buildings in New York City on television, you may have noticed a ticker scrolling on the face of the building.

Today, tickers can be accessed on mobile devices.

For the ticker to have meaning, you need to learn how to interpret the information and how to use it to calculate trading prices, changes, and volume.

CLASS DISCUSSION

Why might an investor be interested in a ticker?
Stock. While actual stock ticker machines are now a thing of the past, the idea of transmitting this important information is not. Ticker machines have been replaced by scrolling data that appears on electronic billboards, computers, and TV screens. Many financial TV programs have stock information scrolling across the bottom of the screen during the trading day.

Stock tickers let you know that a stock transaction (trade) has occurred. The ticker offers the following information in coded format.

- **Stock symbol** or **ticker symbol** The letter or letters used to identify a corporation whose shares are traded on a stock market are stock symbols or ticker symbols.

- **Shares traded** The shares traded is the number of shares bought or sold in a single transaction. Shares traded are listed on the ticker using a shorthand information system. For example, 10K indicates that 10,000 shares traded, 10M indicates that 10,000,000 shares traded, and 10B means that 10,000,000,000 shares traded (rarely seen).

- **Trading price** The trading price per share may be displayed on the ticker preceded by the @ symbol, meaning that each share was traded at the specified price. The @ symbol is not always used.

- **Directional arrows** Arrows indicate whether the traded price of a single share is greater than the previous day's closing price (▲) or less than the previous day's closing price (▼).

**Skills and Strategies**

The following examples show how to interpret stock ticker information.

**EXAMPLE 1**

Marcy is following the stock market ticker scrolling across the bottom of her TV screen on a cable business station. She had purchased some shares of Visa Inc. last week and is interested in seeing if there are any current trades. She knows that Visa Inc. has the ticker symbol V. She saw the following information: V 12K@72.73 ▲ 0.12. What can Marcy learn from this line of symbols?

**SOLUTION** The letter V indicates that a trade has been made for a certain amount of Visa shares. The next piece of information, 12K, indicates that the volume of the most recent trade was 12 thousand shares. Each of those shares was traded at $72.73. This price was up $0.12 from the previous day's closing price (▼).

Cleavon knows that General Electric has the ticker symbol GE. What can Cleavon learn from the following line of symbols: GE 22K@29.40 ▼ 0.5

**CHECK YOUR UNDERSTANDING**

Answer The ticker indicates that 22,000 shares of GE were traded at $29.40 per share, which is down $0.50 from the previous closing price.

**EXTEND YOUR UNDERSTANDING**

Answer The directional arrow would change upward and the amount would be 0.6.
EXAMPLE 2
Tom needed money for graduate school tuition. He called his broker and asked her to sell all 3,000 of his Coca-Cola (KO) shares on Wednesday as soon as the trading price hit $44 per share. Tom knew that Coca-Cola closed at $44.25 on Tuesday. How will his trade appear on the ticker?

SOLUTION Tom is selling 3,000 shares, so the volume is 3K. The sale price of $44 is down from the previous day’s close by $0.25. This trade appears as KO 3K@44 ▼ 0.25.

What would be the previous day’s close for a share of Coca-Cola if the ticker had read KO 3K@44 ▲ 0.25?

CHECK YOUR UNDERSTANDING

EXAMPLE 3
The total value of the trade is the product of the number of shares traded by the price per share. Students can convert the compressed form of the number of shares and then multiply by the price per share. They can also multiply the number in front of the symbol, in this case 15, by the price per share, 78.43, to obtain 1,176,450. Then, multiply that product by the value that the symbol represents, $1,176.45 × 1000 = $1,176,450.

Total Value of a Trade
The total value of a trade is determined by multiplying the number of shares traded by the trading price. This value does not include any fees.

EXAMPLE 3
Toni purchased 15,000 shares of stock of Target Corporation at $78.43 per share. Her trade appeared on the stock ticker as TGT 15K@78.43 ▼ 0.17. What was the total value of her trade?

SOLUTION Each of the shares cost Toni $78.43. Multiply the number of shares by the price to find the total value of her trade.

Number of shares × price 15,000 × 78.43 = 1,176,450

The total value of her trade was $1,176,450.

Suppose Toni made her purchase at the previous day’s closing price. What would have been the difference between the values of the trades?

Trade Volume
Trade volume can appear in decimal formats on the stock ticker. For example, 2.5K is 2.5 thousand, or 2.5 × 1,000, or 2,500. The volume of 3,890,000 shares can be expressed in ticker notation by using the symbol M to represent millions. To determine the number of millions in 3,890,000, divide by 1,000,000. Moving the decimal left six places, 3,890,000 is 3.89 million and is symbolized as 3.89M.
EXAMPLE 4

Grandpa Rich left his three grandchildren Nicole, Jeff, and Kristen a total of 87,500 shares of Apple Inc. (AAPL) in his will. The grandchildren sold all of the shares at a price of $96.91 on Friday. The closing price of Apple on Thursday was $94.83. How did this trade appear on the stock ticker?

SOLUTION Divide the total number of shares by 1,000. Moving the decimal point three places to the left, 87,500 equals 87.5 thousand. The volume of 87,500 shares is 87.5K on the ticker. Because the shares were sold on Friday at a price that was $2.08 higher than the previous day’s close, an upward directional arrow indicated the increase. The trade appeared on the ticker as follows: AAPL 87.5K@96.91 ▲ 2.08.

Express 0.15M shares traded using the K symbol.

Customized Tickers

Some stock traders follow customized tickers that offer trade-to-trade information. The term tick is used whenever there is a change in the price of a share from one trade to the next. A trade is an uptick if the price is at least $0.01 higher than the previous trade. A trade is a downtick if the price is lower. These tick changes contribute to a type of market analysis known as money flow. When a stock is purchased at an uptick, it is positive money flow. When it is purchased at a downtick, it is negative money flow.

A calculated indicator that is the average of a day’s high, low, and close multiplied by the volume for the day is the daily money flow. This calculation can be compared with that for the previous trading day and indicates whether there was a positive or negative money flow. If more shares were bought on the uptick than the downtick, net money flow is positive because more investors were willing to pay a price above the market price.

EXAMPLE 5

Laura is interested in trades of Abercrombie & Fitch (ANF). She has been following the upticks and downticks for the past 2 days. She knows that ANF closed on Tuesday at $20.68, with a high at $21.25 and a low at $20.50. There were 11,902,000 shares traded on that day. She found that Monday’s closing price was $21.23. The high was $21.30 and the low was $19.95. The volume for Monday was 16,537,000 shares. Was the net money flow from Monday to Tuesday positive or negative?

SOLUTION Calculate the average of each day’s high, low, and close and then multiply that by the daily volume.

Find Monday’s average.  \[
\frac{21.30 + 19.95 + 21.23}{3} = 20.83
\]

Multiply price by volume.  \[
20.83 \times 16,537,000 = 344,465,710
\]

Find Tuesday’s average.  \[
\frac{21.25 + 20.50 + 20.68}{3} = 20.81
\]

Multiply price by volume.  \[
20.81 \times 11,902,000 = 247,680,620
\]

There is a negative net money flow from Monday to Tuesday.

Let \( H \) represent a day’s high, \( L \) represent a day’s low, \( C \) represent a day’s close, and \( V \) represent the day’s volume. Write a formula that can be used to determine the day’s money flow.

CHECK YOUR UNDERSTANDING

Answer 150K

Students are asked to convert from one compressed form to another. It is safest to expand the first compressed form and then write that in the second compressed form.

CLASS DISCUSSION

Does daily money flow represent an actual monetary occurrence in the market?

EXAMPLE 5

The average of the high, low, and closing prices on a particular day is used for comparison purposes when examining money flow. It does not represent the average of the day’s trading prices. Multiplying that average by the volume for the day results in a monetary amount, which again can be used for comparison purposes. It indicates the total value of all of the trades during the day when calculating with the comparison average. In Example 5, the money flow for Monday is greater than that for Tuesday. This indicates a negative money flow from Monday to Tuesday.

CHECK YOUR UNDERSTANDING

Answer \( \left( \frac{H + L + C}{3} \right) V \)
1. How might a large trade “move the market”? How might those words apply to what you have learned? See margin.

Use the following ticker information to answer Exercises 2–9. The stock symbols represent the following corporations: HD, Home Depot Inc.; S, Sprint Corp; VZ, Verizon Communications Inc.; and XOM, ExxonMobil Corp.

**Applications**

**TEACH**

**Stock Ticker**

The numbers presented in the stock ticker are compressed as they would appear on an actual ticker. Some students may have difficulty separating the information given on one transaction from the next. Suggest they rewrite the information on the single transaction in question so that they can focus on only the data pertaining to that transaction.

**ANSWERS**

1. Large market trades, whether they are purchases or sales, have large effects on market upticks and downticks since they carry a great deal of weight in determining market averages.

2. Jessica put in an order for some shares of ExxonMobil Corp.
   - a. As shown on the ticker, how many shares did Jessica buy? 660
   - b. How much did each share cost? $81.75
   - c. What was the value of Jessica’s trade? $53,955

3. Phil sold his shares of Verizon Communications Inc., as indicated on the above ticker.
   - a. How many shares did he sell? 3,320
   - b. How much did each share sell for? $51.02
   - c. What was the total value of all the shares Phil sold? $169,386.40

4. How many shares of Home Depot are indicated on the ticker? 32,300,000

5. What is the total value of all of the Sprint Corp shares traded? $3,663

6. How can @126.26 be interpreted? Each share traded at $126.26

7. How can XOM .66K be interpreted? 660 shares of Exxon were traded.

8. How can ▼1.58 be interpreted? The trading price was $1.58 less than the previous close.

9. What was the previous day’s closing price for each stock? HD: $125.13; S: $4.11; VZ: $48.75; XOM: $83.33

Use the following ticker to answer Exercises 10–17. The stock symbols represent the following corporations: PG, Procter & Gamble Co; BAC, Bank of America Corp; DIS, Walt Disney Co; and K, Kellogg Co.

**ANSWERS**

10. Michele is following the trades of Procter & Gamble Co on the business channel. The result of the latest trade is posted on the ticker above.
   - a. How many shares of PG were traded? 4,500
   - b. How much did each share cost? $81.10
   - c. What was the value of the Procter & Gamble Co trade? $364,950
   - d. Suppose that the next PG trade represents a sale of 23,600 shares at a price that is $0.18 higher than the last transaction. What will Michele see scrolling across her screen for this transaction? PG 23.6K@$81.28▼0.21
11. Sarah sold her Disney shares as indicated on the ticker.
   a. How many shares did she sell? 2,550
   b. How much did each share sell for? $95.31
   c. What was the total value of all the shares Sarah sold? $243,040.50
   d. Suppose that the next DIS trade that comes across the ticker represents a sale of 7,600 shares at a price that is $0.98 higher than the last transaction. What will Sarah see scrolling across her screen for this transaction of DIS? DIS 7.6K @ 96.29 ▼ 0.10

12. How many shares of Kellogg Co are indicated on the ticker? 760

13. What is the total value of all of the Bank of America shares traded? $8,255,000

14. How can @ 12.70 be interpreted? Each share traded at $12.70.

15. How can K 0.76K be interpreted? 760 shares of Kellog were traded.

16. How can ▲ 0.04 be interpreted? The trading price is $0.04 higher than the last closing price.

17. What was the previous day's closing price for each stock?
   a. Procter & Gamble Co $81.49
   b. Bank of America Corp $12.16
   c. Walt Disney Co $96.39
   d. Kellogg Co $73.41

18. Write the ticker symbols for each situation.
   a. 36,000 shares of ABC at a price of 37.15, which is $0.72 higher than the previous day’s close ABC 36K @ 37.15 ▲ 0.72
   b. 1,240 shares of XYZ at a price of $9.17, which is $1.01 lower than the previous day’s close XYZ 1.24K @ 9.17 ▼ 1.01

19. Maria is a stock broker and has been following transactions for Ford Motor Co (F). On Tuesday, the last trade of the day for Ford was posted on the ticker as $12.47. On Wednesday, the last trade of the day was $0.56 higher than Tuesday’s close for a purchase of 5,600 shares of Ford. Write the stock ticker symbols that would appear on the scroll for the last trade of the day on Wednesday for Ford. F 5.6K @ 13.03 ▲ 0.56

20. Dorothy purchased x thousand shares of Best Buy Company Inc. (BBY) at y dollars per share. This purchase price reflected a decrease of z dollars from the previous day’s close. Express the ticket symbols algebraically. BBY xK @ y ▼ z

21. Danielle is examining the change in the money flow for Yahoo! Inc. (YHOO) shares on two consecutive dates. The information is given in the table. Do the December 1 numbers reflect a positive or negative money flow? Explain.

<table>
<thead>
<tr>
<th>Date</th>
<th>High</th>
<th>Low</th>
<th>Close</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 1</td>
<td>33.89</td>
<td>33.47</td>
<td>33.71</td>
<td>10,862,500</td>
</tr>
<tr>
<td>Nov. 30</td>
<td>33.83</td>
<td>32.85</td>
<td>33.81</td>
<td>17,363,600</td>
</tr>
</tbody>
</table>

   Determining the product of the average of the three prices and the volume for each day yields a monetary amount on Dec. 1 that is smaller than that on Nov. 30. There is a negative money flow.

22. Isaac follows the market action of Google Inc. He has watched the prices for 2 consecutive days. The information he collected is given in the table. Do the September 23 numbers reflect a positive or negative money flow? Explain.

<table>
<thead>
<tr>
<th>Date</th>
<th>High</th>
<th>Low</th>
<th>Close</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept. 23</td>
<td>628.93</td>
<td>620.00</td>
<td>622.36</td>
<td>1,470,900</td>
</tr>
<tr>
<td>Sept. 22</td>
<td>627.55</td>
<td>615.43</td>
<td>622.69</td>
<td>2,562,900</td>
</tr>
</tbody>
</table>

   Determining the product of the average of the three prices and the volume for each day yields a monetary amount on Sept. 23 that is smaller than the amount on Sept. 22. There is a negative money flow.
8-6 Stock Transactions

When somebody buys a stock it's because they think it's going to go up and the person who sold it to them thinks it's going to go down. Somebody's wrong.

—George Ross, television actor

Objectives
- Define the basic vocabulary of buying and selling shares of stock.
- Compute gains and losses from stock trades.

Key Terms
- trade
- portfolio
- round lot
- odd lot
- gross capital gain
- gross capital loss

Warm-Up
Solve each literal equation for the indicated variable.
Isolate the indicated variable on one side of the equation.

a. Solve for \( x \): \( 2y = (3x - 5)/4 \) \( (8y + 5)/3 \)

b. Solve for \( z \): \( 2y = (3x - 5)/z \) \( (3x - 5)/2y \)

What is a Stock Portfolio?
A stock portfolio is the set of all the stocks a person (or group) currently owns. A portfolio changes whenever stocks are bought or sold. Stocks are best for long-term goals as over time good stocks tend to grow and become more valuable. Stocks can go up or down in value. If the market is volatile, it means there have been recent sudden, extreme changes in stock prices. Because of market volatility, and because some stocks do not perform as planned, it is best to have a diversified portfolio of stocks of different-sized companies in different industries.

When stock is bought and sold, a trade is made with another stockholder. If an investor is buying 600 shares of Xerox Corp, the investor is buying the shares from another shareholder who wants to sell them, not from Xerox Corp. Only the first purchaser of the stock actually bought it from Xerox Corp.

Most shareholders buy and sell stocks in multiples of 100 shares, which are called round lots. A purchase of less than 100 shares is called an odd lot. When you buy stock, even if its value increases, you will not make a profit until you actually sell the stock. If the shares are sold at a higher price than they were purchased for, you make a profit. That is the goal implied by the stock rule of thumb “Buy low, sell high.”

The difference between the selling price and the purchase price is a gross capital gain. If you sell a stock for less money than you paid for it, you have a gross capital loss. You must report capital gains and losses to the Internal Revenue Service because each affects the amount of income taxes owed.
Investors should keep careful track of the stock market and the stocks in their portfolio, so they know when to buy new stocks, add to what they already own, sell, or just hold on to what they own. Here you learn how investors determine their capital gains and losses.

**EXAMPLE 1**

Several years ago, Marlene purchased stock for $7,241. Last week she sold the stock for $9,219. What was her gross capital gain?

**SOLUTION**

Subtract the purchase price from the selling price to find her capital gain.

\[
\text{Selling price} - \text{Purchase price} = 9,219 - 7,241 = 1,978
\]

Marlene has a gross capital gain of $1,978. She must report this as income on her income tax return for the year in which she sold the stock.

Brett used money he received as a gift for high school graduation to purchase $4,000 worth of shares of stock. After he graduated from college, he needed money to buy a car, so he sold the stock for $2,433. What was his capital gain or loss?

**EXAMPLE 2**

Five years ago, Jessica bought 300 shares of a cosmetics company’s stock for $34.87 per share. Yesterday she sold all of the shares for $41 per share. What was her capital gain?

**SOLUTION**

Multiply to find the purchase price of all 300 shares. Multiply to find the selling price of all 300 shares. Subtract to find the capital gain.

\[
\begin{align*}
\text{Multiply purchase price by 300.} & \quad 34.87 \times 300 = 10,461 \\
\text{Multiply selling price by 300.} & \quad 41 \times 300 = 12,300 \\
\text{Subtract.} & \quad 12,300 - 10,461 = 1,839
\end{align*}
\]

Jessica’s gross capital gain was $1,839.

Kelvin bought 125 shares of stock for $68.24 per share. He sold them 9 months later for $85.89 per share. What was his capital gain?

Three years ago, Maxine bought 450 shares of stock for \(x\) dollars per share. She sold them last week for \(y\) dollars per share. Express her capital gain algebraically in terms of \(x\) and \(y\).
EXAMPLE 3
Discuss why the length of time of the investment is a factor in deciding if it was a good investment. In this case, if this gain was made over 5 years, it would have been a good investment. If this gain was made over 30 years, it would not have been as good an investment.

CHECK YOUR UNDERSTANDING
Answer 36%

EXAMPLE 4
Since they are not using numbers in this problem, students may forget that they need to convert to a percent. They must remember to multiply by 100.

CHECK YOUR UNDERSTANDING
Answer $x = \frac{800}{800}(100)$

EXAMPLE 3
Randy paid $3,450 for shares of a corporation that manufactured cell phones. He sold it for $6,100. Express his capital gain as a percent of the original purchase price. Round to the nearest tenth of a percent.

SOLUTION Find the amount of capital gain from the sale.

Capital gain = Selling price − Purchase price

Substitute values.

Capital gain = 6,100 − 3,450 = 2,650

Think of $2,650 as part of a whole. The whole is $3,450. You need to express “what percent of 3,450 is 2,650” as an equation. Let $x$ represent the percent increase, expressed as a decimal.

Write the equation.

$(x)(3,450) = 2,650$

Divide each side of the equation by 3,450.

$x = \frac{2,650}{3,450}$

Calculate.

$x \approx 0.7681$

Randy earned a 76.8% capital gain on his investment.

Allison bought shares in Citigroup Corp in early 2007 for $55 per share. She sold them later that year for $35 per share. Express her loss as a percent of the purchase price. Round to the nearest percent.

EXAMPLE 4
Andy paid $w$ dollars for shares of a corporation that manufactured cell phones. He sold it for $y$ dollars. Express his capital gain as a percent of the original purchase price. Round to the nearest tenth of a percent.

SOLUTION Find the capital gain using variables.

Capital gain = Selling price − Purchase price

Substitute values.

Capital gain = $y - w$

Think of $y - w$ as part of a whole. The whole is $w$. Express “what percent of $w$ is $y - w$” as an equation. Let $x$ represent the percent increase, expressed as a decimal.

Write the equation. Solve for $x$.

$(x)(w) = y - w$

Divide each side of the equation by $w$.

$x = \frac{y - w}{w}$

Andy earned a capital gain of $100 \left(\frac{y - w}{w}\right)$ percent on his investment.

Linda bought $800 of stock in a garden equipment corporation. The selling price is $x$ dollars. Express the percent increase of Linda’s potential capital gain algebraically.
1. Is it always true that someone sells a stock because they think it is going to go down in price? How do those words apply to what you’ve learned in this section? See margin.

2. Zach bought 200 shares of Goshen stock years ago for $21.35 per share. He sold all 200 shares today for $43 per share. What was his gross capital gain?

3. Mitchell bought 600 shares of Centerco 2 years ago for $34.50 per share. He sold them yesterday for $38.64 per share.
   a. What was the percent increase in the price per share? Round to the nearest tenth of a percent. 12%
   b. What was the total purchase price for the 600 shares? $20,700
   c. What was the total selling price for the 600 shares? $23,184
   d. What was the percent capital gain for the 600 shares? Round to the nearest tenth of a percent. 12%
   e. How does the percent increase in the price of one share compare to the percent capital gain for all 600 shares? It is the same.

4. Tori bought $x$ shares of Mattel stock for $m$ dollars per share. She sold all of the shares months later for $y$ dollars per share. Express her capital gain or loss algebraically. $xy - xm$

5. Ramon bought $x$ shares of Xerox stock for a total of $40,000. Express the price he paid per share algebraically. $\frac{40,000}{x}$

6. In 2010, Joe bought 200 shares in Nikon Corp for $22.07 per share. In 2016 he sold the shares for $15.11 each.
   a. What was Joe's capital loss? $1,392
   b. Express Joe's capital loss as a percent, rounded to the nearest percent. 32%

7. General Motors stock fell from $41 per share in 2013 to $24.98 per share during 2016.
   a. If you bought and then sold 300 shares at these prices, what was your loss? $4,806
   b. Express your loss as a percent of the purchase price. Round to the nearest tenth of a percent. 39.1%

8. Elliott purchased shares of Microsoft in 2016 for $52.50 per share. He plans to sell them as soon as the price rises 20%. At what price will he sell his shares? $63

9. Maria purchased 1,000 shares of stock for $35.50 per share in 2014. She sold them in 2016 for $55.10 per share. Express her capital gain as a percent, rounded to the nearest tenth of a percent. 55.2%

10. Austin purchased shares of stock for $x$ dollars in 2015. He sold them years later for $y$ dollars per share.
   a. Express his capital gain algebraically. $y - x$
   b. Express his capital gain as a percent of the purchase price. $\frac{y - x}{x}$
11. During 2003, a share of stock in Coca-Cola Co sold for $39. Michelle bought 300 shares. During 2008, the price hit $56 per share, but she decided to keep them. By 2016, the price of a share had fallen to $44, and she had to sell them because she needed money to buy a new home. Express the decrease in price as a percent of the price in 2008. Round to the nearest tenth of a percent. 27.3%

12. Alexa purchased 700 shares of Campagna Corp stock for \( x \) dollars per share in 2005. She sold them in 2010 for \( y \) dollars per share, where \( y < x \).
   a. Did Alexa have a gross capital gain or a gross capital loss? Explain. See margin.
   b. Alexa used the formula \( \frac{700y - 700x}{700x} \) to compute the percent of the loss.
      Her husband Tom used the formula \( \frac{y - x}{x} \) to compute the percent of the loss. She told him he was incorrect because he didn't take into account that she bought 700 shares. He says that his formula is correct, and so is hers. Who is correct, Alexa or Tom? Explain. See margin.

13. Zeke bought \( g \) shares of stock for \( w \) dollars per share. His broker called him and told him to sell the shares when they earn a 40% capital gain.
   a. Express the total purchase price of all the shares algebraically. \( gw \)
   b. Express the capital gain algebraically. \( 0.4gw \)
   c. Zeke decides to sell his shares. Express the total selling price of all the shares algebraically. \( 1.4gw \)

14. Jake bought \( d \) shares of stock for \( x \) dollars per share years ago. His stock rose in price and eventually hit a price that would earn him a 140% capital gain. He decided to sell half of his \( d \) shares.
   a. Represent half of the \( d \) shares algebraically. \( 0.5d \)
   b. Represent the capital gain earned on each of the shares that were sold algebraically. \( 1.4x \)
   c. Represent the capital gain earned on all of the shares that were sold algebraically. \( 1.4(0.5dx) = 1.2dx \)
   d. Represent the total value of the shares that were sold algebraically.

15. Ahmad sold 125 shares of stock for \( x \) dollars that he had purchased for $32.75 per share.
   a. How much did he originally pay for the shares of stock? \( \$4,093.75 \)
   b. Write an inequality that represents an amount showing Ahmad made money from the sale of the stocks. \( x > 4,093.75 \)
   c. Suppose Ahmad lost money on the stocks. Write an inequality that represents an amount such that Ahmad lost no more than $1,000 from the sale of the stocks. \( 3,093.75 \leq x < 4,093.75 \)
8-7 Stock Transaction Fees

The bad news is time flies. The good news is you’re the pilot.
—Michael Althsuler, businessman

Objectives
- Compute the fees involved in buying and selling stocks.
- Define the basic vocabulary of stock trading.

Key Terms
- stockbroker
- broker fee
- discount broker
- online brokerage house
- full-service broker
- at the market
- limit order
- net proceeds

Warm-Up
Twice a number \( x \) increased by 10 equals 52, and 115 less three times the same number also equals 52.

a. Write two equations in terms of \( x \) for this situation. \( 2x + 10 = 52; 115 - 3x = 52 \)
b. Use your equations to determine the number. \( x = 21 \)

How Do You Buy and Sell Stock?

You don’t buy stock at a store. Shares of stock can only be purchased through a licensed stockbroker. If you decided to sell your shares, you couldn’t bring them to school and sell them to someone in the cafeteria. You also cannot walk into a stock exchange to sell your shares. Only stockbrokers buy and sell stocks. They also give advice to investors. For their services, stockbrokers charge a broker fee. The broker fee can be a flat fee, which does not depend on the value of the transaction, or a commission, which does depend on the value of the transaction. The commission is a percentage of the value of the stock trade.

Some people make their own investment decisions. They read the financial newspapers and websites to learn about new developments in the stock market. They still must buy and sell through brokers, but they may decide to use a discount broker. A discount broker and an online brokerage house charge low fees. They do not give investment advice. They only make stock transactions. Discount brokers are available online, by phone, and in person. An online trading account is convenient because the investor can access it 24 hours a day. A full-service broker gives investment advice and charges higher flat fees, commissions, or a combination of both. Some customers of full-service brokers have “unlimited free trade” accounts, but the brokers charge around 1–2% of the customer’s total assets per year for this service.

If you buy or sell at the market, you are instructing your broker to get the best available price. You can also place a limit order, which specifies the price at which you want to buy or sell. If you put in a limit order to buy a stock only below a specific price, your broker will not make a purchase for any price higher than the price specified. The fees you pay brokers when buying or selling stock affect the amount you gain or lose on the trade. Your net proceeds represent the amount of money you make after broker fees are subtracted. Make sure you are aware of the broker fees whenever you make a stock trade.

EXAMINE THE QUESTION

When the first shares of stock were traded on Wall Street in the 1700s, stock trades took place with stockbrokers meeting face to face. The Internet has drastically changed this.

CLASS DISCUSSION

Have students do an online search for photos of American Stock Exchange brokers outside on the curb, illustrating the phrase “Curb Market.” Also have them research the famous buttonwood tree under which the original 24 brokers of the New York Stock Exchange first met.
To compute the actual gain or loss for a given stock trade, you need to include the broker fees in your calculations.

**EXAMPLE 1**

Deion made two trades through his online discount broker, We-Trade. We-Trade charges a fee of $12 per trade. Deion’s first purchase was for $3,456 and his second purchase, later in the day, was for $2,000. How much did he spend on the day’s purchases, including broker fees?

**SOLUTION**

Deion made two trades. He paid two broker fees.

\[
\text{Fee} \times \text{Number of trades} = 2 \times 12 = 24
\]

Deion paid $24 in broker fees. Next, find the sum of his purchases.

\[
\text{Add amount of both trades} = 3,456 + 2,000 = 5,456
\]

The purchase price of the stock was $5,456.

\[
\text{Find the total spent} = \text{Fee} + \text{Total purchase price} = 24 + 5,456 = 5,480
\]

Deion spent $5,480 on the trades using his online discount broker.

**Check Your Understanding**

Garret made two trades in one day with an online brokerage house that charges $7 per trade. Garret’s first purchase was for $1,790 and his second purchase was for $8,456. How much did he spend including broker fees?

**EXAMPLE 2**

Adriana purchased $7,000 worth of stock in a single trade from a broker at Tenser Brokerage. The current value of Adriana’s portfolio is $11,567. What broker fee must she pay?

**SOLUTION**

Adriana’s fees are in the first row because her portfolio is under $250,000. She is using a broker, so use the fees in the last column. First, multiply the percent expressed as an equivalent decimal by the amount of stock and add $15.

\[
(0.005)(7,000) + 15 = 50
\]

The total broker fee is $50.

**Check Your Understanding**

Jared has a portfolio worth $500,000. He made 10 automated telephone trades during the past year, buying and selling $50,000 worth of stock through Tenser Brokerage. What was his total broker fee for the year? Express his total broker fee algebraically if Jared had made \( b \) automated telephone trades.
EXAMPLE 3

Through Viking Brokerage, Erin purchased $23,510 worth of stock and paid her broker a 1% broker fee. She sold when the stock price increased to $27,300, and used a discount broker who charged $21 per trade. Compute her net proceeds.

SOLUTION

Find the purchase cost.

\[
\text{Purchase cost} = \text{Cost of stock} + \text{Broker fee} = 23,510 + (0.01)(23,510) = 23,745.10
\]

When Erin sold the stock, the broker’s fee was deducted from the sale price. Find Erin’s sale proceeds.

\[
\text{Sale proceeds} = \text{Sale price of stock} - \text{Broker fee} = 27,300 - 21 = 27,279
\]

The net proceeds equals the difference between the purchase cost and the amount she received from her broker.

\[
\text{Net proceeds} = \text{Sale proceeds} - \text{Purchase cost} = 27,279 - 23,745.10 = 3,533.90
\]

Erin’s net proceeds were $3,533.90.

EXAMPLE 4

Johan purchased stock six years ago with a full-service broker for \( x \) dollars and paid a 2% broker fee. He sold that stock yesterday for \( y \) dollars and paid a discount broker $35 for the sale. Express his net proceeds algebraically.

SOLUTION

The purchase cost is the sum of the cost and the broker fee.

\[
\text{Purchase cost} = \text{Cost of stock} + \text{Broker fee} = x + 0.02x
\]

When the stock was sold, the broker fee was $35. The sale proceeds equals the difference of the sale price and the broker fee.

\[
\text{Sale proceeds} = \text{Sale price of stock} - \text{Broker fee} = y - 35
\]

The net proceeds equals the difference between the purchase cost and the amount spent.

\[
\text{Net proceeds} = \text{Sale proceeds} - \text{Purchase cost} = (y - 35) - (x + 0.02x)
\]

Simplify. The net proceeds are \( y - 35 - 1.02x \)

CHECK YOUR UNDERSTANDING

Answer \( \quad -811.63 \)

CHECK YOUR UNDERSTANDING

Answer \( (h - 0.01h) - (p + 40) \)

This is equivalent to \( 0.99h - p - 40 \).
EXAMPLE 5

Darryl is purchasing 700 shares of Buddy Industries through the Creative Brokerage House. Their fee schedule is shown in the table. The shares will cost him $32 each. How much will he pay in broker fees?

<table>
<thead>
<tr>
<th>Value of Shares</th>
<th>Commission Charge</th>
<th>Flat Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0–3,000</td>
<td>1.5%</td>
<td>$40</td>
</tr>
<tr>
<td>$3,001–6,000</td>
<td>0.5%</td>
<td>$60</td>
</tr>
<tr>
<td>$6,001–25,000</td>
<td>0.3%</td>
<td>$75</td>
</tr>
<tr>
<td>$25,001–100,000</td>
<td>0.2%</td>
<td>$95</td>
</tr>
<tr>
<td>$100,001 and over</td>
<td>0.1%</td>
<td>$200</td>
</tr>
</tbody>
</table>

**SOLUTION** Daryl first has to find the total value of this purchase to see which line of the table to use for his fee. He multiplies the number of shares by the price per share.

$$700(32) = 22,400$$

He looks in the first column of the table for the interval that contains $22,400 and sees that the fee is 0.3% of the value of the share, plus a flat fee of $75. He converts 0.3% to a decimal and then multiplies to find the commission charge.

$$22,400(0.003) = 67.20$$

The commission is $67.20. Darryl then adds the flat fee of $75.

$$67.20 + 75 = 142.20$$

The broker fee for this trade is $142.20.

CHECK YOUR UNDERSTANDING

**Answer** $0.001xy + 200

Using the table from Example 5, express the broker fee for x shares of stock at a price of y per share, where $xy > 100,001$, algebraically.
1. How do those words apply to an investor? How do those words apply to a stockbroker? See margin.

2. Carlos does his online trading with Super Trade. Super Trade’s rates are listed in the table below. In a–c, round to the nearest cent.

<table>
<thead>
<tr>
<th>Fee Schedule for Super Trade Discount Broker</th>
<th>Online Trades</th>
<th>Automated Telephone Trades</th>
<th>Telephone to a Live Broker</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 100 trades per year</td>
<td>$17 per trade</td>
<td>Online fee plus $11</td>
<td>$3 \frac{3}{4} % \text{ commission plus online fee}</td>
</tr>
<tr>
<td>100 or more trades per year</td>
<td>$17 per trade for the first 100 trades, $14 per trade for trades over 100</td>
<td>Online fee plus $11</td>
<td>$1 \frac{1}{2} % \text{ commission plus online fee}</td>
</tr>
</tbody>
</table>

a. If Carlos makes 36 online trades in a year, what is the total of his broker fees? $612
b. What is the cost of 99 online trades? $1,683
c. What is the cost of 120 online trades? $1,980
d. If he makes \( t \) online trades in a year, and \( t > 100 \), express the total of his broker fees algebraically. \( 14(t - 100) + 1,700 \)
e. Suppose Carlos made \( q \) online trades and \( t \) automated telephone trades last year, where \( q + t < 100 \). Express the cost of all the trades algebraically.
f. Suppose Carlos makes 20 trades in a year. If Carlos purchased \( x \) shares of stock for \( y \) dollars each using a phone call to a live broker, express the total broker fee algebraically. \( 0.0075xy + 340 \)

3. The ticker shows trades of stock in Hewlett-Packard (HPQ), ExxonMobil (XOM), and Chevron (CVX).

| HPQ 6K10.63▼ 0.23 | XOM 3K81.72▲ 0.08 | CVX 9K84.45▼ 0.22 |

a. How many shares of Hewlett-Packard were sold? 6,000
b. What was the total value of all the HPQ shares sold? $63,780
c. Joan bought the shares at this price, and her broker charged her 1% commission. What was the total cost of her investment? $64,417.80
d. Reggie sold the shares of Exxon-Mobil shown in the above trade, and his broker charged him 1.5% commission. How much money did the broker receive? Round to the nearest cent. $3,677.40
e. Lisa sold the shares of Chevron indicated above through her discount broker, who charges $28 per transaction. How much money did Lisa receive from the above sale after the broker took his fee? $760,022
4. Taylor bought 200 shares of stock for $18.12 per share last year. He paid his broker a flat fee of $30. He sold the stock this morning for $21 per share and paid his broker 0.5% commission.
   a. What were Taylor’s net proceeds? $525
   b. What was his capital gain? $576

5. Laura bought 55 shares of stock for $3.50 per share last year. She paid her broker a 1% commission. She sold the stock this week for $2 per share and paid her broker a $10 flat fee.
   a. What were Laura’s net proceeds? Round to the nearest cent. −$94.43
   b. What was her capital gain or loss? −$82.50; a loss

6. Lenny bought \( x \) shares of stock for \( y \) dollars per share last month. He paid his broker a flat fee of $20. He sold the stock this month for \( p \) dollars per share, and paid his broker a 2% commission. Express Lenny’s net proceeds algebraically:
   \[ 0.98xp - (xy + 20) \]

7. Mackin Investing charges its customers a 1% commission. The Ross Group, a discount broker, charges $25 per trade. For what amount of stock would both brokers charge the same commission? $2,500

8. Fierro Brothers, a discount broker, charges their customers a $19 flat fee per trade. The Sondo Investment House charges a 2% commission. For what amount of stock would both brokers charge the same commission? $950

9. Darlene purchases $20,000 worth of stock on her broker’s advice and pays her broker a 1.5% broker fee. She sells her stock when it increases to $28,600 two years later, and uses a discount broker who charges $21 per trade. Compute Darlene’s net proceeds after the broker fees are taken out. $8,279

10. Alex purchases \( x \) dollars’ worth of stock on his broker’s advice and pays his broker a 1% broker fee. The value of the shares falls to \( y \) dollars years later, and Alex uses a broker who charges 1.25% commission to make the sale. Express his net proceeds algebraically:
    \[ 0.9875y - 1.01x \]

11. Ron bought \( x \) dollars’ worth of stock and paid a \( y \) percent commission. Dave purchased \( p \) dollars’ worth of stock and paid a \( q \) percent commission, where \( x > p \). Pick numbers for \( x, y, p, \) and \( q \) such that Ron’s commission is less than Dave’s. Answers vary. See margin.

12. Debbie buys 400 shares of stock for $23 per share and pays a 1% commission. She sells them 6 years later for $23.25 per share, and pays a $30 flat fee. Are her net proceeds positive or negative? Explain. See margin.

13. Sal bought \( x \) shares of a stock that sold for $23.50 per share. He paid a 1% commission on the sale. The total cost of his investment, including the broker fee, was $3,560.25. How many shares did Sal purchase? 150
8-8 Stock Splits

Why Do Corporations Split Stocks?

Suppose that someone approaches you to give you two $10 bills in exchange for a $20 bill. That might appear to be a worthless transaction because the value of the exchanged monies is the same. Having two $10 bills might better suit one party and having a single $20 bill might better suit the other. This is exactly what happens when a corporation offers its shareholders a stock split. To understand what happens when stocks split, it is first necessary to understand two important and related terms: outstanding shares and market capitalization. The total number of all shares issued by a corporation that are in investors’ hands are outstanding shares. The total value of all of a company’s outstanding shares is market capitalization, or market cap.

When a stock is split, a corporation changes the number of outstanding shares while, at the same time, it adjusts the price per share so that the market cap remains unchanged. In the opening situation, the number of bills doubled, while the value of each bill was halved. The total value of twenty dollars remained unchanged.

Why would a corporation institute a split if it is a monetary nonevent? Many say that the reason is perception. The psychology of a split depends on the type of split. In a traditional stock split, the value of a share and the number of shares are changed in such a proportional way that the value decreases as the number of shares increases while the market cap remains the same. These types of splits are announced in the form a for b where a > b. For example, one of the most common traditional splits is the 2-for-1 split. The investor gets two shares for every one share held while the price per share is cut in half. Although nothing has changed in the market value of the shares, the perception is that the investor sees the stock as more affordable. Investors may be attracted to this stock because the market price per share has been lowered, and they can afford to buy more shares.

EXAMINE THE QUESTION

Stock splits have been occurring for decades. IBM had its first split in 1926. Caterpillar had two splits in one year, 1926. Disney has had many splits in its history.

One reason for a split might be that the stock price has gotten too high and therefore priced itself out of the market. The other reason is that the stock price has gotten too low and appears to be a worthless investment.

CLASS DISCUSSION

How do you think the perception of change might lead to an increase in sales and market prices?

Objectives

- Calculate the post-split outstanding shares and share price for a traditional split.
- Calculate the post-split outstanding shares and share price for a reverse split.
- Calculate the fractional value amount that a shareholder receives after a split.

Key Terms

stock split
outstanding shares
market capitalization
traditional stock split
reverse stock split
penny stock
fractional part of a share

Warm-Up

Given: One-half of x minus one-half of y equals –4.

a. Write an equation. \( 0.5x - 0.5y = -4 \)

b. Solve the equation for \( x \). \( x = y - 8 \)

c. Solve the equation for \( y \). \( y = 8 + x \)

Perception is strong and sight is weak. In strategy, it is important to see distant things as if they were close and to take a distanced view of close things.

—Miyamoto Musashi, Japanese samurai, artist, and strategist
In a reverse stock split, the effect is just the opposite. The number of outstanding shares is reduced and the market price per share is increased. As the price per share increases, the investor perceives that the stock is worth more. This often happens to stocks known as penny stocks, whose value is less than $5 per share. To increase the perceived value, the corporation may increase the price per share while at the same time decreasing the number of shares outstanding. This type of split is in the form \(a < b\) where \(a < b\). For example, in a 1-for-2 split, the investor holding shares would now own one share for every two previously held. The price for that share would have doubled. The market capitalization remains the same.

The saying “perception is reality” holds true for the stock market. Although stock splits may not initially alter the value of shares held, the perception of change may lead to increases in sales and market prices.

### Skills and Strategies

Here you learn how to interpret and calculate stock splits.

#### EXAMPLE 1

On April 9, Starbucks Corp (SBUX) instituted a 2-for-1 stock split. Before the split, the market share price was $95.30 per share and the corporation had 749 million shares outstanding. What was the pre-split market cap for Starbucks?

**SOLUTION**

The market cap before the split is determined by multiplying the number of outstanding shares by the market price at that time.

\[ \text{Pre-split market cap} = \text{Number of shares} \times \text{Market price} \]

\[ = 749,000,000 \times 95.30 \]

\[ = 71,379,700,000 \]

The pre-split market cap is $71,379,700,000.

A corporation has a market capitalization of $24,000,000,000 with 250,000,000 outstanding shares. Calculate the price per share.

#### EXAMPLE 2

What was the post-split number of shares outstanding for Starbucks in Example 1?

**SOLUTION**

Use a proportion. Because every shareholder gets two shares for every one share held, it makes sense that the post-split number of shares should be twice the pre-split number of shares for individual holdings and for the number of shares.

\[ \frac{2}{1} = \frac{x}{749,000,000} \]

Cross multiply. \(x = 2 \times 749,000,000\)

After the split, there will be 1,498,000,000, or 1.498B, shares outstanding.
EXAMPLE 3
What was the post-split market price per share for Starbucks in Example 1? How many shares are outstanding? Did the market cap change after the split?

**SOLUTION** This was a 2-for-1 stock split, so the new share price is one-half the old share price.

\[
\frac{1}{2} \times 95.30 = 47.65
\]

In a 2-for-1 split, the number of shares are doubled, so there are now

\[
2 \times 749M = 1.498B \text{ shares}
\]

The post-split market cap is \(47.65 \times 1.498B = $71,379,700,000\), which is the same as it was before.

In October, Johnson Controls Inc. instituted a 3-for-1 split. After the split, the price of one share was $39.24. What was the pre-split price per share?

**Check Your Understanding**

**Post-Split Market Price and Number of Outstanding Shares**

In general, in any \(a\)-for-\(b\) split, you can apply the following formulas:

\[
\begin{align*}
\text{Post-split number of shares} & = \frac{a}{b} \times \text{Pre-split number of shares} \\
\text{Post-split share price} & = \frac{b}{a} \times \text{Pre-split share price}
\end{align*}
\]

**EXAMPLE 4**

On May 9, Citigroup Inc. (C) instituted a 1-for-10 reverse stock split. Before the split, the market share price was $4.48, and there were 29B shares. What was the post-split share price and number of shares?

**SOLUTION**

Write the 1-for-10 reverse stock split as the ratio \(\frac{1}{10}\).

\[
\begin{align*}
\text{Post-split number of shares} & = \frac{a}{b} \times \text{Pre-split number of shares} \\
& = \frac{1}{10} \times 29,000,000,000 = 2,900,000,000 \\
\text{Post-split share price} & = \frac{b}{a} \times \text{Pre-split share price} \\
& = \frac{10}{1} \times 4.48 = 44.80
\end{align*}
\]

After the split, there were 2.9B shares outstanding with each share having a value of $44.80. Notice that the pre-split market cap, 29B $4.48, and the post-split market cap, 2.9B $44.80, both equal $129,920,000,000, or $129.92B.
A major drugstore chain whose stocks are traded on the New York Stock Exchange was considering a 2-for-5 reverse split. If the pre-split market cap was $1.71B, what would the post-split market cap be?

Suppose that before a stock split, a share was selling for $2.35. After the stock split, the price was $7.05 per share. What was the stock-split ratio?

**Fractional Part of a Share**
The previous examples had shares that could be split into whole-number amounts. In reality, this may not be the case. Often the split would create a fractional part of a share. In other words, there is less than one share remaining. When this happens, the corporation buys the fractional share at the current market price.

**EXAMPLE 5**
Steve owned 942 shares of a manufacturing company. On January 3, a 5-for-4 split was announced. The stock was selling at $56 per share before the split. How was Steve financially affected by the split?

**SOLUTION**
Write the split as a ratio. Use the pre-split information to find the post-split values.

\[
\text{Post-split number of shares} = \frac{a}{b} \times \text{Pre-split number of shares}
\]
\[
= \frac{5}{4} \times 942 = 1,177.5
\]

\[
\text{Post-split share price} = \frac{b}{a} \times \text{Pre-split share price}
\]
\[
= \frac{4}{5} \times 56 = 44.80
\]

Fractional shares are not traded, so the corporation paid him the market value of 0.5 shares.

\[
\text{Fractional part} \times \text{Market price} = 0.5 \times 44.80 = 22.40
\]

Steve received $22.40 in cash and 1,177 shares worth $44.80 each.

**CHECK YOUR UNDERSTANDING**
Gabriella owned 1,045 shares of Hollow Zee Corp at a price of $62.79. The stock split 3-for-2. How was Gabriella financially affected by the split?

**CHECK YOUR UNDERSTANDING**
Gabriella received 1,567 shares and was refunded for the overage of 0.5 share.

**Check Your Understanding**
This is a multistep problem. Students need to calculate the post-split price per share and the number of shares. Mathematically, the post-split number of shares is 1,567.5. The refund is calculated by multiplying 0.5 by the post-split price per share (0.5 $41.86 = $20.93).
1. Why should investors be cautious when a split occurs? How might those words apply to what you have learned? See margin.

2. In February, Robbins and Myers Inc. executed a 2-for-1 split. Janine had 470 shares before the split. Each share was worth $69.48.
   a. How many shares did she hold after the split? 940
   b. What was the post-split price per share? $34.74
   c. Show that the split was a monetary nonevent for Janine. Her holdings remain at $32,655.60.

3. On June 5, CIGNA instituted a 3-for-1 stock split. Before the split, CIGNA had 200 million shares with a price of $168 per share.
   a. How many shares were outstanding after the split? 600M
   b. What was the post-split price per share? $56
   c. Show that this split was a monetary nonevent for the corporation.
      See Additional Answers.

4. Vilma owns 750 shares of Torchmark. On July 2, the corporation instituted a 3-for-2 split. Before the split, each share was worth $82.44.
   a. How many shares did Vilma hold after the split? 1,125
   b. What was the post-price per share after the split? $54.96
   c. Show that the split was a monetary nonevent for Vilma.
      See Additional Answers.

5. Mike owns 2,400 shares of JXV. The company instituted a 1-for-8 reverse stock split on October 17. The pre-split market price per share was $2.13.
   a. How many shares did Mike hold after the split? 300
   b. What was the post-split price per share? $17.04
   c. Show that the split was a monetary nonevent for Mike.
      See Additional Answers.

6. Versant Corp executed a 1-for-10 reverse split on August 22. At the time, the corporation had 35,608,800 shares outstanding, and the pre-split price per share was $0.41.
   a. How many shares were outstanding after the split? 3,560,880
   b. What was the pre-split price per share after the split? $4.10
   c. Show that this split was a monetary nonevent for the corporation.
      See Additional Answers.

7. Kristy owns 200 shares of Nortel stock. On November 30, the company instituted a 1-for-10 reverse split. The pre-split price per share was $2.15. The number of shares outstanding before the split was 4.34B.
   a. How many shares did Kristy hold after the split? 20
   b. What was the post-split price per share? $21.50
   c. What was the post-split number of outstanding shares? 434,000,000
   d. What was the post-split market cap? $9,331B

TEACH

Exercises 2 and 3
Some students may need to solve these problems using a proportion, while others may be able to calculate the solution through simple multiplication. Both methods are valid and should be addressed when reviewing the solutions.

Exercise 4
Stock splits that do not contain a 1 in the denominator are often difficult for students to understand. In this case, the stockholder gets three shares for every two shares owned. In reviewing the problem, you might show the equivalence of this situation and the split of 1.5 to 1.

Exercises 5–7
Before assigning these problems, make sure that students have an understanding of the reverse split. In particular, what such a split does to the number of shares held and what it does to the price per share.

ANSWERS

1. Musashi urges people to “see distant things as if they are close and take a close view of distant things.” In other words, be cautious because things may not always appear to be what they really are. Perception changes reality.
Jon noticed that most traditional splits are in the form \( x \)-for-1. He says that in those cases, all you need do is multiply the number of shares held by \( x \) and divide the price per share by \( x \) to get the post-split numbers. Answer Exercises 8–9 based on Jon’s method.

8. Verify that Jon’s method works to determine the post-split price and shares outstanding for HVC, which executed a 4-for-1 split on July 10 with 22,676,800 outstanding shares and a market price of $203.80 per share before the split. See margin.

9. Jon also noticed that every traditional split ratio can be written in the form \( x \)-for-1. Examine how the 3-for-2 traditional split can be expressed as 1.5-for-1.

\[
\frac{3}{2} = \frac{x}{1} \rightarrow 3 = 2x \rightarrow x = 1.5
\]

Express each of the following traditional split ratios as \( x \)-for-1.

- a. 5-for-4
- b. 6-for-5
- c. 5-for-2
- d. 8-for-5

10. Monarch Financial Holdings Inc. executed a 6-for-5 traditional split on October 5. Before the split there were approximately 4,800,000 shares outstanding, each at a share price of $18.00.

a. Use the method outlined in Examples 2 and 3 to determine the post-split share price and number of shares outstanding. See margin.

b. Compare the results from part a with those obtained by using Jon’s method from exercises 8 and 9. Jon’s method says that 6-for-5 is the same as 1.2-for-1. The post-split values are the same.

11. On June 19, NoteQuest Inc. instituted a 3-for-2 split. At that time Keisha owned 205 shares of that stock. The price per share was $33.99. After the split, Keisha received a check for a fractional part of a share. What was the amount of that check? $11.33

12. On December 14, XTO Energy Inc. executed a 5-for-4 split. At that time, Bill owned 325 shares of that stock. The price per share was $65.80. After the split he received a check for a fractional part of a share. What was the amount of that check? $13.16

Use the following spreadsheet to answer Exercises 13–15. The ratio for the split is entered in cells B2 and C2. For example, the ratio of 2-for-1 would be entered as a 2 in B2 and a 1 in C2. The number of pre-split shares is entered in B3 and the pre-split price is entered in B4.

13. Write the spreadsheet formula that will calculate the post-split number of outstanding shares in C3. \( =B2/C2*B3 \)

14. Write the spreadsheet formula that will calculate the post-split price per share in C4. \( =C2/B2*B4 \)

15. Write the pre-split market cap formula in cell B5 and the post-split market cap formula in C5. \( =B4*B3; =C4*C3 \)
Warm-Up

If \( X \) represents the price of an item in dollars, and \( Y \) is a percent, interpret each expression.

a. \( X \left( \frac{Y}{100} \right) \)

b. \( X + X \left( \frac{Y}{100} \right) \)

EXAMINE THE QUESTION

When you own shares of stock in a corporation, you can receive a dividend check. That dividend check is your part of the profit. Have students research the history of dividends for major corporations. Some corporations issue quarterly dividends, some issue annual dividends, while some do not issue any dividends at all.

If Shareholders Own a Corporation, Are They Entitled to Some of the Profits?

If you buy a stock and watch its price rise, it’s exciting, but your profit is only realized when you actually sell it. If you buy a stock and watch its price fall, it can be devastating. People have bought stock and watched its price rise for years, and then held on to it only to watch the price fall below what they paid for the stock. Keep in mind that gains and losses cannot be computed and are not assured until the stock is actually sold.

However, your stock portfolio can earn income before you sell your shares. Remember, a shareholder is an owner of a corporation. As owners, shareholders are entitled to their portions of the corporation’s profit. A profit split among shareholders is called a dividend. Money received from dividends is dividend income. Dividends are usually paid annually or quarterly. The board of directors of the corporation sets the dividend for one share of stock. For major public corporations this information can be found under a column headed “Div” in the stock table. Your total dividend depends on the number of shares you own. Some corporations do not pay a dividend because the profit is being used to improve or grow the corporation. Some corporations do not pay a dividend because they have no profit. They are operating at a loss. A stock that pays dividends is called an income stock because it provides their owners with income.

Some people buy income stocks, which pay dividends for the additional income. The yield of a stock is the percentage value of the dividend, compared to the current price per share. Investors use the yield to compare their dividend income to the interest they could have made if they put the money in the bank.
instead of buying the stock. Other investors are not concerned with dividend income. Instead, they want to buy low and sell high. A stock that is bought for this reason is called a growth stock. A stock can be both an income and a growth stock.

Stock is also classified as preferred stock or common stock. Preferred stockholders receive their dividends before common stockholders do, and they usually receive a set dividend that does not frequently change. Common stockholders receive dividends only when the board of directors elects to issue these dividends. Additionally, if a company goes out of business, preferred stockholders are entitled to assets and earnings of the company, ahead of common stockholders.

Dividend payments are mailed to shareholders or electronically transferred to their accounts. Dividend payments can range in value from a few cents to thousands of dollars because they depend on how much the dividend is and how many shares are owned. Remember that dividends are not guaranteed and can be cut or eliminated if the company decides they need the money. Most companies do not like to cut dividends and disappoint shareholders.

Skills and Strategies

If your stock pays a dividend, you want to make sure the amount you are receiving is correct. You also want to be aware of how dividend income compares to the bank interest you could have made if you decided to put the money in the bank instead of buying the stock. Just remember that your principal is guaranteed in a bank, while the value of your stocks can be very volatile. A dividend can be eliminated, and you can actually lose all of your investment in the stock market.

EXAMPLE 1

Roberta is considering purchasing a common stock that pays an annual dividend of $2.13 per share. If she purchases 700 shares for $45.16 per share, what would her quarterly income be from dividends?

SOLUTION

The price paid per share is not needed to compute the annual dividend. To find the annual income from dividends, multiply the number of shares by the annual dividend per share.

\[
\text{Income from dividends} = \text{Number of shares} \times \text{Dividend per share}
\]

\[
= 700 \times 2.13 = 1,491
\]

The annual income from dividends is $1,491. Divide by 4 to get the quarterly dividend.

\[
1,491 \div 4 = 372.75.
\]

Roberta should receive $372.75 as her quarterly dividend payment.

Jacques purchased \(x\) shares of a corporation that pays a \(y\) dollar annual dividend. What is his annual dividend income, expressed algebraically?
To find the yield of a stock, write the ratio of the annual dividend per share to the current price of the stock per share and convert to a percent. A yield can change even when a dividend amount does not because the price of the stock changes frequently.

**EXAMPLE 2**

Elyse owns 2,000 shares of a corporation that pays a quarterly dividend of $0.51 per share. How much should she expect to receive in a year from dividends?

**SOLUTION**

First, compute her quarterly dividend by multiplying the total number of shares by the quarterly dividend per share.

\[
\text{Income from dividends} = \text{Number of shares} \times \text{Dividend per share} = 2,000 \times 0.51 = 1,020
\]

To find the amount she should expect to receive in a year, multiply by 4.

\[
1,020 \times 4 = 4,080
\]

Elyse should receive $4,080 in a year.

**EXAMPLE 3**

Kristen owns common stock in Max’s Toy Den. The annual dividend is $1.40. The current price is $57.40 per share. What is the yield of the stock to the nearest tenth of a percent?

**SOLUTION**

Write the yield as a fraction. Then convert the fraction to a decimal. Finally, write the decimal as a percent.

\[
\text{Yield} = \frac{\text{Annual dividend per share}}{\text{Current price of one share}} = \frac{1.40}{57.40} = 0.0243902, \text{ or } 2.4390\%
\]

The yield is about 2.4%.

Suppose you buy \(x\) shares of a stock for \(y\) dollars per share. The annual dividend per share is \(d\) dollars. Express the percent yield algebraically.
EXAMPLE 4
This reviews how the net change is used to compute a previous day's close.

CHECK YOUR UNDERSTANDING
Answer \(100 \left( \frac{1.55}{x - 0.40} \right)\)
Make sure students notice they are asked for yesterday's yield.

EXAMPLE 4
One share of BeepCo preferred stock pays an annual dividend of $1.20. Today BeepCo closed at $34.50 with a net change of $-0.50. What was the stock's yield at yesterday's closing price?

SOLUTION Use today's close and the net change to find yesterday's close.
Today's close + Oppose of net change \(34.50 - (-0.50) = 35\)
Yesterday's close was $35.00.

\[
\text{Yield} = \frac{1.20}{35} = 0.03429, \text{ or } 3.4\%
\]
At yesterday's close, the yield was about 3.4%.

Check Your Understanding
One share of Skroy Corp stock pays an annual dividend of $1.55. Today Skroy closed at \(x\) dollars with a net change of +0.40. Express the yield at yesterday's close algebraically.

EXAMPLE 5
Point out that when a stock splits, the yield does not change, because the price of a share and the dividend are both divided by the same number.

CHECK YOUR UNDERSTANDING
Answer $1.40

EXAMPLE 5
A stock paid an annual dividend of $2.14. The stock split 2-for-1. What is the annual dividend after the split?

SOLUTION After a 2-for-1 split, there are twice as many shares outstanding, so divide the dividend by 2

\[2.14 \div 2 = 1.07\]
The new annual dividend per share is $1.07.

Check Your Understanding
A corporation was paying a $2.10 annual dividend. The stock underwent a 3-for-2 split. What is the new annual dividend per share?
Corporate Bonds

Buying stock has risks and rewards. If you do not want to take a significant risk, you can invest in corporate bonds. A corporate bond is a loan to a corporation. The corporation agrees to pay the bondholder back with interest, much like a bank does to customers with money on deposit. The interest is usually paid annually or semi-annually. Usually, corporate bonds are for $1,000 or $5,000. This amount is the face value and is the amount paid when the bond matures. When the bond matures, the bondholder receives the face value from the corporation, and the loan to the corporation is over. Bondholders do not share in any profits, and they do not own part of the corporation. Investors that buy bonds enjoy less risk but have lower potential rewards.

The maturity date of a bond is a date in the future when the principal invested will be repaid to the investor. The time to maturity can be a short period or as long as 30 years. Upon maturity, an investor will receive the amount originally invested back from the corporation. Bonds that take longer to mature generally pay a higher interest rate. Bondholders can sell their bonds if they decide not to keep them until the maturity date.

**EXAMPLE 6**

Adam bought a $1,000 corporate bond in Labate Corp. The bond pays 5.7% interest per year. How much does Adam receive in interest each year from this bond?

**SOLUTION** To find the annual interest, first convert the percent to an equivalent decimal.

\[ 5.7\% = 0.057 \]

Then, multiply the interest expressed as a decimal by the face value.

Multiply interest rate by 1,000. \[ 0.057 \times 1,000 = 57 \]

Adam receives $57 in annual interest.

If Adam holds the bond from Example 6 for 11 years, how much will he receive in total interest?
1. Based on what you learned about dividends, why are nondividend stocks compared to baseball cards? See margin.

2. Years ago, Home Depot had an annual dividend of $0.90. If you owned 4,000 shares of Home Depot, how much did you receive annually in dividends? $3,600

3. Barnes and Noble had a $0.15 annual dividend during 2016. If you owned 500 shares of Barnes and Noble at that time, how much did you receive on a quarterly dividend check? $18.75

4. If you own \( r \) shares of a stock with an annual dividend of \( p \) dollars, express the amount of your quarterly dividends algebraically. \( \frac{rp}{4} \)

5. The quarterly dividend for Tiffany, a jewelry company, was $0.40 during the first quarter of 2016. What was the annual dividend for 2,000 shares at that time? $3,200

6. Mike owned 3,000 shares of CreeChurrs Corp and received a quarterly dividend check for $1,140. What was the annual dividend for one share of CreeChurrs? $1.52

7. Jean owned \( x \) shares of a corporation and received a quarterly dividend check for \( y \) dollars. Express the annual dividend for one share algebraically. \( \frac{4y}{x} \)

8. Walt Disney Co paid a $1.42 annual dividend on a day it closed at a price of $96 per share.
   a. What was the annual dividend for 500 shares? \( \$710 \)
   b. What was the quarterly dividend for 500 shares? \( \$177.50 \)
   c. Express the yield as a fraction. \( \frac{1.42}{96} \)
   d. What was the yield to the nearest tenth of a percent? \( 1.5\% \)

9. You own \( k \) shares of a stock that is selling for \( x \) dollars per share. The quarterly dividend is \( y \) dollars per share.
   a. Express the annual dividend for one share algebraically. \( 4y \)
   b. Express the annual dividend for all \( k \) shares algebraically.
   c. Express the yield as an algebraic fraction. \( \frac{4y}{kx} \)

10. The spreadsheet on the right can be used to compute the yield. Write the formula that can be used to compute the yield in cell C2. \( \frac{(B2/A2)\times100}{x} \)

11. Black Oyster Corp is going out of business. All of the corporate assets are being sold. The money raised will be split by the stockholders. Which stockholders, the common or preferred, receive money first? Preferred
12. A share of Southside stock sold for $37. The annual dividend is $1.85. Three years later the stock has increased 17% in value and the dividend has increased 5%.
   a. What is the price per share 3 years later? $43.29
   b. What is the dividend 3 years later? Round to the nearest cent. $1.94
   c. What is the yield 3 years later? Round to the nearest tenth of a percent. 4.5%

13. Revreg Corp pays an annual dividend of $1.60 per share. On Friday it closed at $44 per share with a net change of +0.35. The dividend did not change.
   a. What was the yield on Friday? Round to the nearest tenth of a percent. 3.7%
   b. What was the yield at Thursday's close? Round to the nearest tenth of a percent. 3.6%
   c. What was the yield at Wednesday's close? Round to the nearest tenth of a percent. 3.8%

14. The Zeescore Corporation pays an annual dividend of $2 per share. On Wednesday it closed at $61 per share with a net change of −0.85. The dividend remained at $2 for a year.
   a. What was the yield on Wednesday? Round to the nearest tenth of a percent. 3.3%
   b. At what price did Zeescore close on Tuesday? $61.85
   c. What was the yield on Tuesday? Round to the nearest tenth of a percent. 3.2%
   d. Tuesday’s net change was −1.96. At what price did Zeescore close on Monday? $63.81
   e. What was Monday’s yield? Round to the nearest tenth of a percent. 3.1%
   f. Look at the yields for Wednesday, Thursday, and Friday. They are decreasing. Explain why this decrease is not “bad news” to the investor who owns stock in Revreg. See margin.

15. Sascha owns stock in Lewis Corp, and she bought a $1,000 corporate bond. The bond pays 6.34% annual interest.
   a. How much will Sascha receive in annual interest? $63.40
   b. How much will Sascha receive in interest if she holds the bond for 14 years? $887.60
   c. Sascha's stock is worth $46 per share, and it pays a $2 annual dividend. What is the yield? Round to the nearest tenth of a percent. 4.3%
   d. Which is higher, the yield on the stock or the interest rate on the bond? Bond
   e. How much does Lewis Corp pay Sascha when the bond matures? $1,000

16. Stock in the Happy's Burger chain was selling for $54.24 per share, and it was paying a $2.46 annual dividend. It underwent a 3-for-1 split.
   a. What was the new price of one share after the split? $18.08
   b. If you owned 200 shares before the split, how many shares did you own after the split? 600
   c. Following the same pattern, what was the annual dividend per share after the split? $0.82

17. Talia bought a $5,000 Pelts Corp bond. The bond pays 5.95% annual interest. How much will Talia receive in interest if she holds the bond for 11 years? $3,272.50
Chapter 8  Assessment

Real Numbers

You Write the Story!!
Examine the graph below. Write a short news-type article, using facts obtained online or at the library, centered around this graph. You can find an electronic copy of the graph at www.cengage.com/financial_alg2e. Copy and paste it into your article.

What’s the Problem?
1. Examine the equation below used for determining the capital gain made on a stock. Look through this chapter and your notes to help you write a problem that could be modeled by this equation.

\[((900)(12.55) - (900)(12.55)(.01)) - ((900)(8.14) + 25)\] = 3,831.05

A person bought 900 shares at $8.14 per share and paid a flat broker fee of $25. They sold the shares for $12.55 each and paid a 1% broker fee. What was their capital gain?

Reality Check
1. Choose a corporation that you are interested in following. Use the newspaper or Internet to find the daily low, high, close, and volume of your stock for the next 3 weeks. Set up a graph to record these prices and the volume. Discuss the trends for the 3-week period. Check the corporation’s website for major news about the corporation. Do a regression analysis for the last 15 trading days of this stock. Discuss the trend over the 3 weeks and include any major corporate news that might have affected the trend.

2. Discuss stocks with your parents or guardians. Find out if they own any stocks now, or ever did. If you earn money, discuss with them the possibility of purchasing shares of stock for a corporation you are interested in following.
3. Survey your classmates and compile a list of questions they have about stocks. Compile a list of the top five stocks they are interested in. Call a local stockbroker and request an appointment for a short meeting. Interview the broker. Ask the broker why these stocks may or may not be a good investment. Report your findings to the class.

4. Visit a local bank that has a financial advisor. Make an appointment to speak with the financial advisor. Ask the advisor if they would be willing to come to school and speak to your class about different types of investments. Choose a student to moderate the session. Prepare questions and share them with the advisor before the session.

5. Visit a local bank and ask to speak to one of the representatives about U.S. savings bonds. Find out about the forms necessary to purchase a bond, the interest it pays, and how long the bonds take to reach their face value. Prepare a report and present your findings to the class.

6. Contact a local stockbroker. Talk to your teacher about setting up a class session featuring the stockbroker as a guest speaker. During the broker's presentation, conduct a question-and-answer session.

7. Contact the New York Stock Exchange by mail or through its website. Request a list of publications and downloads that the Exchange offers.

8. Research a corporation. Prepare a poster, slide show, or PowerPoint presentation about the corporation. Include how and when the corporation was founded, where it got its name, major developments in its history, and why you may or may not want to invest in this company.

9. Work with a small group of classmates to create a stock portfolio of 5–10 stocks. Assume you are working with an initial hypothetical investment of $100,000. Track the gains and losses of your entire portfolio for 2 months. Compare your total profit or loss with that of other groups.

10. Pick a dozen well-known corporations. Do an Internet search to find out how they were named, what their logo represents, and how their logo has changed over the decades. Prepare your findings in a PowerPoint presentation.

11. Do an Internet search for the names of 10 corporations that have had a stock split in recent years. Identify the type and value of the split. Search on finance.yahoo.com for historical prices around the date of the split. Use that data to confirm the accuracy of the split.

12. Search online to find the historical closing prices for 20 consecutive trading days of any corporate stock. Determine and graph the 5-day, 9-day, and 12-day simple moving averages. Identify the crossovers and the implications of those crossovers.

13. In this chapter you learned about the stock market. Do you have a specific interest related to any of the topics discussed? For this project you will design your own project assignment based on your interests. Read all of the Reality Check projects to get a basic idea of what comprises a project assignment. When you have decided on a project topic and plan, download the project proposal form at www.cengage.com/financial_alg2e and carefully complete the project information. Create a project assignment for a project you would like to complete. You will need to get it approved by your teacher before undertaking the project. Upon teacher approval, complete the project you have created.

REALITY CHECK
Projects can be presented to the class on any schedule that works for your program. Some of these projects require students to take little field trips, so they cannot conduct all their research online. Remind students who visit local businesses or community members that they are representing the school and need to be cordial. Students visiting local businesses should send a thank-you letter to the business.
Google is derived from the number googol, which is a 1 with 100 zeros following it. This is equivalent to \(10^{100}\). Despite the original accidental change in spelling (but not pronunciation), the name still elicits the idea of something very large. How large is \(10^{100}\)? There isn’t a googol of anything on the planet! Let’s take a look at some surprisingly large and surprisingly small numbers.

Given that 1,000,000 pennies stacked one on top of another reaches about 1 mile high, how high would 1 googol pennies reach?

To get an idea of the “power” of exponents, investigate a famous problem in mathematics.

How many times would you have to fold a piece of paper so it reached from Earth to the Sun, approximately 93 million miles?

1. A ream of paper (500 sheets) is 2 inches thick. What is the thickness of one sheet of paper? 0.004
2. Take a sheet of paper and fold it as many times as you can. For the rest of the problem you will have to imagine that you could continually fold the piece of paper. Number of possible folds varies.
3. Convert 93 million miles into inches. 5,892,480,000,000
4. Each fold represents a doubling of the previous thickness, so each fold multiplies the paper thickness by \(2^x\). Use your calculator and trial and error to find the lowest value of \(x\) for which the answer exceeds 93 million miles.

5. You were probably unable to fold the paper more than six or seven times, so you had to imagine the doubling of the thickness mathematically. After viewing the thickness of the paper after six folds, are you surprised at how few folds it will take the thickness of the paper to reach the sun? The “power” of 2 is amazing!

### Applications

1. Nick and Matt are partners in a local health food store. They needed $73,000 to start the business. They invested in the ratio 3:7, Nick to Matt.
   a. How much money did each invest? Nick: $21,900; Matt: $51,100
   b. What percent of the business was owned by Matt? Round to the nearest tenth of a percent. 70%

2. Tom purchased shares of DuPont for $47.65 per share. He plans to sell the shares when the stock price rises 20%. At what price will he sell his shares? $57.18

3. The top three shareholders in a certain corporation each own \(s\) shares of stock. The corporation’s ownership is represented by a total of \(x\) shares of stock. Express the percent of the corporation owned by the top three shareholders algebraically. \[ \left( \frac{3s}{x} \right) \times 100 \]

4. Maribel purchased 2,000 shares of stock for $25.43 per share. She sold them for $44.10 per share. Express her capital gain to the nearest tenth of a percent. 73.4%

5. A local hairstylist bought 450 shares of a cosmetics corporation for $33.50 per share. He sold the shares for $39.01 per share.
   a. What was the percent increase in the price per share? Round to the nearest tenth of a percent. 16.4%
   b. What was the total purchase price for the 450 shares? $15,075
   c. What was the total selling price for the 450 shares? $17,554.50
   d. What was the percent capital gain for the 450 shares? Round to the nearest tenth of a percent. 16.4%
6. Deanna purchased $24,000 worth of stock and paid her broker a 1% broker fee. She sold the stock when it increased to $29,100 3 years later and used a discount broker who charged $35 per trade. Compute her net proceeds after the broker fees were taken out. $4,825

7. Bootle Corp paid Leslie a quarterly dividend payment for $828. Leslie owns 450 shares of Bootle. What was the quarterly dividend for one share of Bootle? $1.84

8. Aaron owned \(x\) shares of a corporation and received an annual dividend of \(y\) dollars. Express the quarterly dividend for one share algebraically. \(\frac{y}{4}\)

9. Zyco Corp pays an annual dividend of $2.10 per share. On Tuesday it closed at $72 per share with a net change of +0.95. The dividend remained at $2.10 for several months.
   a. What was the yield on Tuesday? Round to the nearest tenth of a percent. 2.9%
   b. At what price did Zyco close on Monday? $71.05
   c. What was the yield at Monday's close? Round to the nearest tenth of a percent. 3%

10. Use the table below to answer a-h.
   a. What was the difference between the 52-week high and the 52-week low for one share of AT&T? $6.63
   b. What was the difference between the day's high and low for one share of Southern Copper? $0.01
   c. Which stock had a close that was furthest from the day's low? JPM
   d. Determine the close on March 2 for JPMorgan Chase. $56.34
   e. How many shares of ITT were traded on March 3? 140,460
   f. What was the percent net change from March 2 to March 3 for AT&T? Round to the nearest hundredth of a percent. -0.03%
   g. Which stock had a day's high that was approximately 30% less than its 52-week high? Southern Copper
   h. On March 2, there were 19,987,655 shares of JPM traded. What was the difference in the number of shares traded from March 2 to March 3? 1,000,125

**Market Data, As of the Close on March 3**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Stock</th>
<th>52-Week High</th>
<th>52-Week Low</th>
<th>Last</th>
<th>Change</th>
<th>Sales Volume</th>
<th>High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCCO</td>
<td>Southern Copper</td>
<td>29.53</td>
<td>19.90</td>
<td>22.06</td>
<td>-1.79</td>
<td>1,823.7</td>
<td>22.07</td>
<td>22.06</td>
</tr>
<tr>
<td>T</td>
<td>AT&amp;T</td>
<td>37.50</td>
<td>30.97</td>
<td>37.12</td>
<td>-0.01</td>
<td>22,009</td>
<td>37.50</td>
<td>37.06</td>
</tr>
<tr>
<td>ESI</td>
<td>ITT Ed Services</td>
<td>7.95</td>
<td>1.93</td>
<td>2.95</td>
<td>-0.03</td>
<td>140.46</td>
<td>3.11</td>
<td>2.92</td>
</tr>
<tr>
<td>JPM</td>
<td>JPMorgan Chase &amp; Co.</td>
<td>70.61</td>
<td>57.07</td>
<td>57.45</td>
<td>+1.11</td>
<td>20,987.78</td>
<td>58.11</td>
<td>57.14</td>
</tr>
</tbody>
</table>

11. Use the stock bar chart to answer the questions below.
   a. What was the day's open on June 17? $49.60
   b. What was the approximate difference between the day's high and low on June 18? $1.00
   c. On what day was the close also the day's low? June 20
   d. Write the approximate 750,000 volume for June 19.
12. Use the candlestick chart to answer the questions below.
   a. What was the approximate low on June 20? $24.13
   b. What was the approximate high on this date? $24.63
   c. What was the difference between the opening price and the closing price? approx. $0.33
   d. What does the red candlestick color indicate?

13. Lea owns 800 shares of ABC Inc. On April 6, the corporation instituted a 5-for-2 stock split. Before the split, each share was worth $42.60.
   a. How many shares did Lea hold after the split? 2,000
   b. What was the post-split price per share? $17.04
   c. Show that the split was a monetary nonevent for Lea.

14. Gene owns 1,200 shares of XYX Corp. The company instituted a 1-for-10 reverse stock split on November 7. The pre-split market price per share was $1.20.
   a. How many shares did Gene hold after the split? 120
   b. What was the post-split price per share? $12.00
   c. Show that the split was a monetary nonevent for Gene.

15. Use the table of closing prices for Microsoft. Round answers to the nearest cent.
   a. Determine the 3-day simple moving averages. See margin.
   b. Determine the 10-day simple moving averages. See margin.

16. Use the following stock market ticker to answer Exercises 16 and 17.

   GE 29.39K@26.13▲1.13 F .67K@12.46▼0.38 C3K@42.15▲ 1.47 T 1.6K@37.12▼1.08
   a. How many shares did Nick buy? 670
   b. How much did each share cost? $12.46
   c. What was the value of Nick’s trade? $8,348.20

17. Patrick sold his shares of AT&T (T).
   a. How many shares did he sell? 1,600
   b. For how much did each share sell? $37.12
   c. Based on Patrick’s sale, what was the closing price of T on the previous trading day? $38.20

18. The stock in a real-estate corporation was selling for $78 per share with an annual dividend of $1.86. It underwent a 3-for-2 split.
   a. What was the value of one share of the stock after the split? $52
   b. What was the annual dividend after the split? $1.24

19. A stock that was selling for \( x \) dollars per share underwent a \( y \)-for-\( p \) split. It was originally paying an annual dividend of \( d \) dollars per share. Express the annual dividend after the split algebraically.

20. Suki purchased $9,600 worth of stock and paid her broker a 1.75% broker fee. She had an immediate need for cash and was forced to sell the stock when it was worth $8,800. She used a discount broker who charged $32.50 per trade. Compute Suki’s net loss after the broker fees were taken out. $1,000.50

21. Use the following 25 consecutive days’ closing prices for AT&T to determine linear, quadratic, cubic, and quartic regression equations. Starting with 1/27 as day 1, 1/28 as day 2, etc., use the ordered pairs (1, 35.48), (2, 35.53) . . . in the form (day number, closing price). What trends do you see? What are your predictions for the closing price on the 26th trading day? See margin.

<table>
<thead>
<tr>
<th>Date</th>
<th>Closing Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/27</td>
<td>35.48</td>
</tr>
<tr>
<td>1/28</td>
<td>35.53</td>
</tr>
<tr>
<td>1/29</td>
<td>36.06</td>
</tr>
<tr>
<td>2/1</td>
<td>36.18</td>
</tr>
<tr>
<td>2/2</td>
<td>36.06</td>
</tr>
<tr>
<td>2/3</td>
<td>36.72</td>
</tr>
<tr>
<td>2/4</td>
<td>36.53</td>
</tr>
<tr>
<td>2/5</td>
<td>36.88</td>
</tr>
<tr>
<td>2/8</td>
<td>37.11</td>
</tr>
<tr>
<td>2/9</td>
<td>36.65</td>
</tr>
<tr>
<td>2/10</td>
<td>36.43</td>
</tr>
<tr>
<td>2/11</td>
<td>36.21</td>
</tr>
<tr>
<td>2/12</td>
<td>36.47</td>
</tr>
<tr>
<td>2/16</td>
<td>36.65</td>
</tr>
<tr>
<td>2/17</td>
<td>36.64</td>
</tr>
<tr>
<td>2/18</td>
<td>36.99</td>
</tr>
<tr>
<td>2/19</td>
<td>36.57</td>
</tr>
<tr>
<td>2/22</td>
<td>36.86</td>
</tr>
<tr>
<td>2/23</td>
<td>37.74</td>
</tr>
<tr>
<td>2/24</td>
<td>37.1</td>
</tr>
<tr>
<td>2/25</td>
<td>37.37</td>
</tr>
<tr>
<td>2/26</td>
<td>37.13</td>
</tr>
<tr>
<td>2/29</td>
<td>36.95</td>
</tr>
<tr>
<td>3/1</td>
<td>37.39</td>
</tr>
<tr>
<td>3/2</td>
<td>37.69</td>
</tr>
</tbody>
</table>

21. Linear: \( y = 0.0603x + 35.871 \)
   Quadratic: \( y = -0.0009x^2 + 0.0839x + 35.765 \)
   Cubic: \( y = 0.0006x^3 - 0.026x^2 + 0.3498x + 35.133 \)
   Quartic: \( y = -0.00004x^4 + 0.0026x^3 - 0.0598x^2 + 0.5544x + 34.831 \)

Although the closing prices fluctuate, generally there is an increasing trend in those prices.

Predictions for day 26:
   Linear: $37.44
   Quadratic: $37.34
   Cubic: $37.20
   Quartic: $36.24