Business Mathematics

13TH EDITION

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Contents

Preface

FROM THE AUTHORS

The thirteenth edition of *Business Mathematics* has been revised to improve readability and currency and to motivate students by using interesting examples from business and personal finance. Additional focus has been placed on real-world business applications. A different, well-known company is highlighted at the beginning of each chapter and used throughout that chapter in discussions, examples, exercises, and a case. Each chapter ends with two business application cases that help students integrate the concepts using a business setting. Numerous new graphs, news clippings, and photographs have been added to increase the relevance of the material to the world that students know, and discussion of the recent financial crisis has been added to help students better understand what has happened. The globalization of our society is also emphasized through examples and exercises that highlight foreign countries and international topics.

This text teaches math calculations in the context of business applications. An important goal of the text is to develop students' understanding of both to the point where they can figure out which calculations apply when presented with an unfamiliar situation. In this sense, we seek to develop a level of business "intuition" by having them work through the integrative cases, a wide-range of application exercises, writing and investigative questions, and discussions about current and relevant data. Additionally, we also seek to help students develop intuition related to business by discussing topics such as global supply chains, inventory, the financial crisis, debt, etc. These topics are widely discussed in advanced courses in four year programs at colleges and universities throughout the world.

The new edition reflects the extensive business and teaching experience of the authors, college faculty who have previously worked in and owned businesses. It also incorporates ideas for improvement from reviewers nationwide as well as students who have taken the course. We focus on providing solid, practical, and up-to-date coverage of business mathematics topics beginning with a brief review of basic mathematics, and go on to introduce key business topics, such as bank services, payroll, business discounts and markups, simple and compound interest, stocks and bonds, consumer loans, taxes and insurance, depreciation, financial statements, and business statistics. Two appendices have been added to this edition for those who have requested more algebra and/or who have an interest in graphs.

The traditional concept of learning has evolved based on knowledge that students learn in a variety of ways and that many classes are at least partly taught online or in labs. To support student learning in this multidimensional world, we have developed an outstanding supplemental learning package of print and digital products including the industry-leading MyMathLab. Numerous studies have shown that MyMathLab can greatly increase student learning and retention by presenting material in a variety of formats to suit all types of student learning styles.

Our state-of-the-art supplements package includes revised video lectures, case study videos, an enhanced PowerPoint package, student's solutions manual, an extensive instructor's manual, printed quick reference tables, and a wealth of online resources for instructors and students including MathXL online and MyMathLab. We hope this text and package satisfies all of your classroom needs. Please feel free to contact us with any questions or concerns. Use "Business Math" in the regarding line.

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The Business Mathematics, 13th Edition, Learning System

This textbook has evolved over the years as thousands of students and hundreds of instructors have used the book and told us what works and what doesn't. *Business Mathematics*, 13th edition, Learning System is the result of this process of refinement that informs both the printed textbook and our new MathXL and MyMathLab applications for online. The goal of this textbook is for students to develop the computational skills they will need to be successful in the world of business along with a better understanding of business concepts and situations that require a mathematical solution. Each chapter is set up to teach a math concept and its applications in the following pattern:

1. A **'Case in Point' company profile** introduces the student to a company and a situation that requires math calculations.

2. A **clear explanation** of the math concept is presented, followed by **examples with detailed solutions**.

3. Students immediately apply the math concept to a similar problem in a **Quick-Check problem** to test their understanding.

4. **Solution steps,** detailing how to solve problems, are summarized in a shaded box.

5. **Quick Tips** provide students with helpful tips and cautions.

6. **Business applications** are found in examples, exercises, cases and discussion, and features such as Numbers in the News and newspaper clippings providing business and economic information.

7. **An Exercise Set** follows each section of the book providing a wealth of practice opportunities to develop computational skills. The exercises are paired, graded from simple to more complex, and conclude with numerous titled application word problems. Each type of exercise is preceded with a **Quick Start** worked example to help get students started.

8. **Additional Problem Sets** and **Supplementary Exercises** are embedded in select chapters for topics that students find difficult and typically require additional work.

9. A **Quick Review** section at the end of the chapter presents students with an overview of the math concepts covered in the chapter.

10. Two case studies require students to use math concepts to solve business problems in real companies. The first **Case Study** is a shorter case application, while the second **Case in Point Summary Exercise** revisits the chapter opening company with a more in-depth application. Both cases end with Discussion or Investigate questions that encourage further thinking.

11. Finally, a chapter concluding **Test** allows students to gauge their mastery of all chapter concepts and applications.

12. **Cumulative Review Problem Sets** appear every 2–4 chapters. These problems cover all math concepts covered in the preceding chapters and help students retain math concepts throughout the course.

BUILDING CALCULATOR SKILLS

This text provides the following resources to help students build calculator skills:

Calculator Solutions Calculator solutions, identified with the calculator symbol ▦, appear after selected examples. These solutions show students the keystrokes needed to solve the problem in the Example.

Basic Calculator Instruction in Appendix B presents detailed coverage of basic calculators for professors who allow students to use calculators.

Financial Calculator Instruction in Appendix C reviews the basic functions of financial calculators using present value and future value. The financial calculator solutions are shown in shaded boxes along with the ▦ for some examples in the text.

NEW CONTENT HIGHLIGHTS

Many changes have been made in the 13th edition. Here is a list of the changes by chapter:

- Chapters 1 through 3 have been reworked and several examples have been updated. The figures in Chapter 3 (Percents) related to increase and decrease problems have been modified to improve student learning.

- Chapter 4 (Equations and Formulas) has been updated and significant additional material related to algebra has been added with the addition of Appendix D (Exponents and Order of Operations) and Appendix E (Graphing Equations). Appendix E can be used, in combination with the many figures and charts throughout the book, to improve students' abilities to interpret data.

- Chapter 5 (Bank Services) has been extensively reworked to bring it up-to-date in the continually changing world of banking in a global, wired world. Discussion has been added explaining how electronic banking is a backbone for business. Discussion about how important it is to control costs in business as well as how internet transactions have reduced costs for businesses has been included.

- Chapter 6 (Payroll) has been updated and includes the most recent information related to Social Security, Medicare, and income tax withholding. Figures in the chapter show percent of workers living on the edge due to insufficient savings, the value of higher education, average salaries for various sales careers, and a chart listing the median wage of a wide range of workers by job/career. The history of Social Security and Medicare are outlined. The Case in Point Summary exercise asks students to take on the role of a manager preparing a payroll at a Starbucks.

- Chapter 7: Mathematics of Buying introduces e-commerce and the resulting changes in business operations. A new topic is introduced: the retail supply chain. Students are encouraged to think as managers about invoices and discounts based on the amount purchased or the timing of payments. The importance of controlling costs is emphasized in the chapter and in the case on managing inventory at Bed, Bath and Beyond.

- Chapter 8: Mathematics of Selling is introduced using Recreational Equipment, Inc. (REI) which is one of the premier sporting goods and mountaineering stores in the country. To enhance student understanding of supply chain issues in retail, the discussion on tracking inventory has been expanded and data showing the growth of online retail sales is included. Figures have also been changed to enhance student understanding. ▦

- Chapter 9: Simple Interest has been updated to reflect current interest rates. Rather than just giving formulas and calculations, this chapter was written to help students gain insights about the importance of interest rates in business and life. For example, a graph showing housing starts and interest rates is included along with a discussion of why high interest rates usually result in lower housing starts. Also, an explanation is given about how the government uses interest rates to help control the growth rate of the economy which in turn affects the number of jobs. The company highlighted is Apple, Inc.

- Chapter 10: Compound Interest and Inflation shows the benefits of compounding interest over periods of time. Inflation is defined and examples are included to show the effect of inflation on earning power. Deflation is also defined since it is a topic currently in the news. One of the cases at the end of the chapter describes the serious financial effects of the recent collapse in real estate prices on a home builder.

- Chapter 11: Annuities, Stocks, and Bonds uses both examples and exercises to emphasize the value of long-term saving for students and businesses. It includes descriptions of the basic types of retirement accounts and explains how divorced couples can use annuities for alimony and child support payments. The chapter highlights a recent graduate that works for a community college as he makes choices about the retirement plan offered by his employer. It also discusses stocks and bonds as investments.

- Chapter 12: Business and Consumer Loans now has a greater emphasis on student debt. The sections on Credit Cards, Installment Loans, and Real Estate Loans will be of special interest to students. A discussion of FICO score has been added and tips are given to help students improve their own score which will improve their ability to obtain credit. One of the cases at the end of the chapter shows how a family reduces monthly payments by refinancing. The second case highlights a family that is "under water" on their home, meaning that the debt on the home is greater than its market value.

- In Chapter 13: Taxes and Insurance, additional discussion has been added showing students where tax dollars go and all personal income tax applications have been updated using the most current tax laws. A new figure shows where the government gets its money from and where it goes. All personal income tax applications have been updated using the most current tax laws. The company highlighted in the chapter Mattel Inc., has significant international sales. Discussion has been added showing the effects of the recent financial crisis on the budget in a local school district.

- Chapter 14: Depreciation contains the most recent federal laws and guidelines.

- Chapter 15: Financial Statements and Ratios features Apple, Inc. Recent financial statements from the company are shown so that students can learn based on a company they know and from which they buy products.

- Many of the problems in Chapter 16: Business Statistics have been changed. It includes numerous graphs with data related to business or the economy, including average credit card debt, states with serious budget problems, top tax rates, and average costs of medical treatment. Concepts are introduced throughout the chapter using a deli and highlighted in a case related to cooking show host Bobby Flay in a case at the end of the chapter.

Student and Instructor Supplements

RESOURCES FOR STUDENTS

Classroom Lectures and Case Studies contain a comprehensive lecture for each section of the text, along with case study videos that profile real companies from the in-text Case Studies. These videos are available in MyMathLab.

Student's Solutions Manual This supplement contains the complete, worked-out solutions to all of the odd-numbered exercises in the text. This manual can be ordered alone or packaged with the textbook for an additional cost. ISBN: 0-321-95870-5

RESOURCES FOR INSTRUCTORS

Online Instructor's Solutions Manual (Download only) This supplement contains the complete, worked-out solutions to all of the exercises in the text. Available for download in MyMathLab and the Instructor's Resource Center. ISBN: 0-321-95872-1

Online Instructor's Resource Manual (Download only) contains teaching suggestions; two pretests—one in basic mathematics and one in business mathematics; six different test forms for each chapter (four short answer and two multiple choice); two final examinations; numerous application exercises (test items) for each chapter; answers to all test materials; suggested answers to the writing questions in the text; and a selection of tables from the text. Available for download in MyMathLab and the Instructor's Resource Center. ISBN: 0-321-95871-3

MEDIA RESOURCES

MYMATHLAB® ONLINE COURSE (ACCESS CODE REQUIRED)

MyMathLab from Pearson is the world's leading online resource in mathematics, integrating interactive homework, assessment, and media in a flexible, easy to use format. MyMathLab delivers **proven results** in helping individual students succeed. It provides **engaging experiences** that personalize, stimulate, and measure learning for each student. And, it comes from an **experienced partner** with educational expertise and an eye on the future.

To learn more about how MyMathLab combines proven learning applications with powerful assessment, visit **www.mymathlab.com** or contact your Pearson representative.

MYMATHLAB® READY TO GO COURSE (ACCESS CODE REQUIRED)

These new Ready to Go courses provide students with all the same great MyMathLab features, but make it easier for instructors to get started. Each course includes preassigned homework and quizzes to make creating a course even simpler. Ask your Pearson representative about the details for this particular course or to see a copy of this course.

MATHXL® ONLINE COURSE (ACCESS CODE REQUIRED)

MathXL® is the homework and assessment engine that runs MyMathLab.
(MyMathLab is MathXL plus a learning management system.)

With MathXL, instructors can:

- Create, edit, and assign online homework and tests using algorithmically generated exercises correlated at the objective level to the textbook.
- Create and assign their own online exercises and import TestGen tests for added flexibility.
- Maintain records of all student work tracked in MathXL's online gradebook.

With MathXL, students can:

- Take chapter tests in MathXL and receive personalized study plans and/or personalized homework assignments based on their test results.
- Use the study plan and/or the homework to link directly to tutorial exercises for the objectives they need to study.
- Access supplemental animations and video clips directly from selected exercises.

MathXL is available to qualified adopters. For more information, visit our website at www.mathxl.com, or contact your Pearson representative.

TESTGEN®

TestGen® (www.pearsoned.com/testgen) enables instructors to build, edit, print, and administer tests using a computerized bank of questions developed to cover all the objectives of the text. TestGen is algorithmically based, allowing instructors to create multiple but equivalent versions of the same question or test with the click of a button. Instructors can also modify test bank questions or add new questions. The software and testbank are available for download from Pearson Education's online catalog.

POWERPOINT® LECTURE SLIDES

The PowerPoint Lecture Slides contain coverage of all chapter concepts illustrated with new problems not found in the book and many of the even numbered exercises from the exercise set.

Learning Tips for Students

SUCCESS IN BUSINESS MATHEMATICS

This text applies mathematics to solve problems in business. Your success in future business courses and pursuits will be enhanced by the knowledge and skills you will gain in this course. It is very important to realize that your future employer is far more interested in your ability to solve problems than whether you remember a particular formula or how to work one type of problem. So, the goal of this book is both to educate you about business mathematics and importantly to also help you become a better problem solver.

Studying business mathematics is different from studying subjects like English or history. The key to success is *regular practice*. This should not be surprising. After all, can you learn to ski or play a guitar without regular practice? The same is true for learning mathematics. Working problems nearly every day *is the key to becoming successful*. Here are some suggestions to help you succeed in business mathematics.

1. **Attend class regularly. Try to pay careful attention and take notes.** In particular, write down the problems the instructor works on the board.

2. **Ask questions in class.** It is not a sign of weakness, but of strength. There are always other students with the same question who are too shy to ask.

3. **Read the book carefully, maybe twice, and spend time using the online materials.** Studying each topic will help you solve the homework problems. Most exercises are keyed to specific examples or objectives that will explain the procedure for working them.

4. **Before doing your homework, look at the problems the teacher worked in class.** This will reinforce what you have learned. Many students say, "I understand it perfectly when you do it, but I get stuck when I try to work the problem myself."

5. **Read the section and review your notes before starting your homework.** Check your work against the answers in the back of the book. If you get a problem wrong and are unable to understand why, mark that problem and ask your instructor about it. Then practice working additional problems of the same type to reinforce what you have learned.

6. **Work as neatly as you can using a pencil, and organize your work carefully.** Write your symbols clearly, and make sure the problems are clearly separated from each other. Working neatly will help you to think clearly and also make it easier to review the homework before a test.

7. **After you complete a homework assignment, look over the text again.** Try to identify the main ideas that are in the lesson. Often they are clearly highlighted or boxed in the text.

8. **Use the chapter test at the end of each chapter as a practice test.** Work through the problems under test conditions, without referring to the text or the answers until you are finished. You may want to time yourself to see how long it takes you. When you finish, check your answers against those in the back of the book, and study the problems you missed.

9. **Keep all quizzes and tests that are returned to you, and use them when you study for future tests and the final exam.** These quizzes and tests indicate what concepts your instructor considers to be most important. Be sure to correct any problems on these tests that you missed so you will have the corrected work to study.

10. **Don't worry if you do not understand a new topic right away.** As you read more about it and work through the problems, you will gain understanding. Each time you review a topic, you will understand it a little better. Few people understand each topic completely right from the start.

Business Mathematics Pretest

This pretest will help you determine your areas of strength and weakness in the business mathematics presented in this book.

1. Round 5.46 to the nearest tenth.

2. Round $.064 to the nearest cent.

3. Round $399.49 to the nearest dollar.

4. Multiply: $\begin{array}{r} 7801 \\ \times\ 1758 \end{array}$

5. Divide: $35\overline{)11{,}032}$

6. Change $8\frac{7}{8}$ to an improper fraction.

7. Change $\frac{40}{26}$ to a mixed number.

8. Write $\frac{15}{21}$ in lowest terms.

9. Add: $\begin{array}{r} \frac{3}{4} \\ \frac{1}{2} \\ +\ \frac{7}{8} \end{array}$

10. Add: $\begin{array}{r} 2\frac{2}{3} \\ 7\frac{1}{4} \\ +\ 10\frac{1}{2} \end{array}$

11. Subtract: $\frac{3}{8} - \frac{7}{24}$

12. Subtract: $\begin{array}{r} 83\frac{3}{4} \\ -21\frac{2}{5} \end{array}$

13. Multiply: $\frac{3}{8} \times \frac{3}{5}$

14. Divide: $15\frac{1}{4} \div 5\frac{1}{8}$

15. Express .625 as a common fraction.

16. Express $\frac{3}{5}$ as a decimal.

17. Subtract: $\begin{array}{r} 598.316 \\ -\ 79.839 \end{array}$

18. Multiply: $\begin{array}{r} 30.67 \\ \times\ 5.39 \end{array}$

19. Divide: $1.2\overline{)309.6}$

20. Express $\frac{7}{8}$ as a percent.

21. Intelnet spent 5.2% of its sales on advertising. If sales amounted to $864,250, what amount was spent on advertising?

22. What annual rate of return is needed to receive $930 in one year on an investment of $18,600?

23. Home Entertainment Systems offers a 60-inch LCD HDTV at a list price of $2459 less trade discounts of 20/10. What is the net cost?

24. A department head at Old Navy is paid $16.80 per hour with time and a half for all hours over 40 in a week. Find the employee's gross pay if she worked 43 hours in one week.

25. How long will it take an investment of $12,500 to earn $125 in interest at 4% per year? (*Hint:* Use Bankers Interest, i.e., assume 360 day year.)

26. An invoice from Collier Windows amounting to $20,250 is dated October 6 and offers terms of 3/10, n/30. If the invoice is paid on October 14, what amount is due?

27. Find the percent of markup based on selling price if some home exercise equipment costing $1584 is sold for $1980.

28. Find the single discount equivalent to a series discount of 30/20.

29. Using the straight-line method of depreciation, find the annual depreciation on a Bobcat loader that has a cost of $18,750, an estimated life of six years, and a scrap value of $750.

30. Whiting's Oak Furniture sells a dining room set for $1462.98 after deducting 26% from the original price. Find the original price.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____
23. _____
24. _____
25. _____
26. _____
27. _____
28. _____
29. _____
30. _____

Index of Applications

1 Whole Numbers and Decimals

▼ CASE IN POINT

JESSICA FERNANDEZ worked part time for SUBWAY when taking classes at a local community college, but she is now a manager that oversees 18 employees. She looks for employees that have a good work ethic, are honest and friendly, and who can work with numbers. She uses numbers daily to schedule employees, compute sales, figure sales taxes, complete the payroll, and order inventory.

This text will improve your ability to work with numbers which is important! It also teaches you important concepts that relate to your personal life (debt, savings, investment, home mortgages, insurance, and taxes) and the workplace (markup, markdown, bank services, payroll, and simple interest). You will use the concepts covered in this book throughout your life.

1.1 Whole Numbers

OBJECTIVES

1 Define whole numbers.
2 Round whole numbers.
3 Add whole numbers.
4 Round numbers to estimate an answer.
5 Subtract whole numbers.
6 Multiply whole numbers.
7 Multiply by omitting zeros.
8 Divide whole numbers.

CASE IN POINT To improve the efficiency of workers at the SUBWAY store she manages, Jessica Fernandez cross-trains each employee so that she can do several tasks, including food preparation, cleanup, and operating the cash register. After watching an employee give a customer too much change for a second time, a frustrated Jessica Fernandez decided that any new hire must pass a basic math test.

OBJECTIVE 1 Define whole numbers. The **decimal system** uses the ten one-place **digits:** 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. Combinations of these digits represent any number needed. The starting point of this system is the **decimal point (.)**. This section considers only the numbers made up of digits to the left of the decimal point—the **whole numbers**. The following diagram names the first fifteen places held by the digits to the left of the decimal point.

A researcher estimated that 581,075,900 smart phones will be sold in 2015. Use a **comma** to work with numbers this large. Starting at the decimal place and moving to the left, place a comma between each group of three digits. Although commas are always used when writing numbers, they are not shown on some calculators. Commas are not required for numbers with four digits such as 8475.
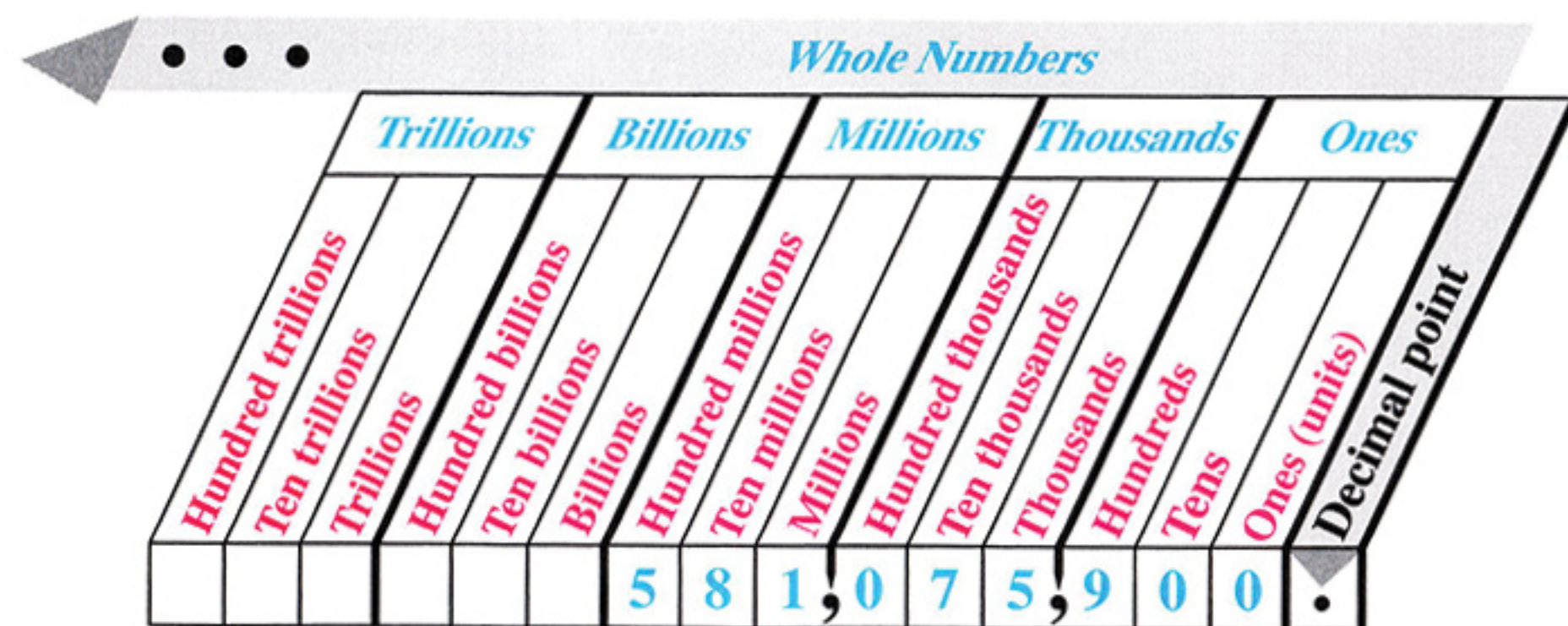
The number 581,075,900 is read as

five hundred eighty-one million, seventy-five thousand, nine hundred.

Notice that the word "*and*" is not used with whole numbers. The word "*and*" is used for the decimal place, as discussed in Section 1.3.

Expressing Whole Numbers in Words

EXAMPLE 1 Write the following numbers in words.

(a) 7835   (b) 111,356,075   (c) 17,000,017,000

SOLUTION

(a) seven thousand, eight hundred thirty-five

(b) one hundred eleven million, three hundred fifty-six thousand, seventy-five

(c) seventeen billion, seventeen thousand

Quick TIP

Do not use the word "*and*" when reading or writing a whole number.

QUICK CHECK 1

At one point in 2013, the national debt of the United States was $16,810,680,391,540. Write the number in words.

OBJECTIVE 2 Round whole numbers. Business applications often require **rounding** numbers. For example, money amounts are often rounded to the nearest thousand or million dollars. Use these steps to **round whole numbers**.

> **Rounding Whole Numbers**
>
> Step 1   Locate the **place** to which the number is to be rounded. Draw a line under that place.
>
> Step 2   If the first digit to the *right* of the underlined place is **5 or more, increase** the digit in the place to which you are rounding by 1.
>
> If the digit is **4 or less, do not change**.
>
> Step 3   **Change** all digits to the right of the underlined digit to zeros.

Rounding Whole Numbers   ▶ **EXAMPLE 2**   Round each number as indicated.

(a) 579 to nearest ten

(b) 34,127 to nearest thousand

(c) 475,871 to the nearest ten thousand

(d) 79,625 to nearest thousand

SOLUTION

(a) Step 1   Locate the tens place and underline.

<div align="center">

579
↑
└─── **Round to this place.**

</div>

Step 2   The first digit to the right of the underlined digit is 9, which is greater than 5. Therefore, increase the digit in the tens place from 7 to 8.

Step 3   Change all digits to the right of the tens place to zero. In other words, change the 9 in the ones place to a zero.

<div align="center">

579 rounded to the nearest ten is 580.

</div>

(b) Step 1   Locate the thousands place and underline. 34,127

Step 2   Since the digit to the right of the thousands place is 1 (less than 5), do not change the 4 in the thousands place.

Step 3   Change all digits to the right of the thousands place to zeros.

<div align="center">

34,127 rounded to the nearest thousand is 34,000

</div>

(c) Step 1   Locate the ten thousands place and underline. 475,871

Step 2   Since the digit to the right of the ten thousands place is 5, which falls in the category of 5 or more, increase the 7 to an 8.

Step 3   Change all digits to the right of the tens thousands place to zeros: **480,000**

(d) Step 1   Locate the thousands place and underline. 79,625

Step 2   The number to the right of the underlined number 9 above is 5, which falls in the 5 or more category. Thus, increase the 9 by 1 to 10. Place a 0 in the thousands place and carry 1 to the ten thousands place changing the 7 to an 8.

Step 3   Change all digits to the right of the thousands place to zeros: **80,000**

> **Quick TIP**
>
> When rounding a number, look at the first digit to the right of the digit being rounded. Do not look beyond this digit.

> **QUICK CHECK 2**
>
> Round each number.
>
> (a) 653,781 to the nearest ten thousand   (b) 6,578,321 to the nearest million
>
> (c) 499,100 to the nearest thousand   (d) 499,100 to the nearest hundred thousand

We will now review four basic **operations** with whole numbers: **addition, subtraction, multiplication**, and **division**.

OBJECTIVE 3   Add whole numbers. In **addition**, the numbers being added are **addends**, and the answer is the **sum**, or **total**, or **amount**.

<div align="center">

8	addend
+ 9	addend
17	sum (answer)

</div>

Add numbers by arranging them in a column with units above units, tens above tens, hundreds above hundreds, thousands above thousands, and so on. Use the decimal point as a reference for arranging the numbers. If a number does not include a decimal point, the decimal point is assumed to be at the far right. For example, 85 = 85. and 527 = 527.

Adding with Checking   **EXAMPLE 3**

To find the one-day total amount of purchases at the SUBWAY store, manager Jessica Fernandez needed to add the following amounts.

$$
\begin{array}{r}
\$4028 \\
\$738 \\
63 \\
125 \\
2617 \\
+\quad 485 \\
\hline
\$4028
\end{array}
$$

First, add down the columns

Then, check by adding up.

Adding from the top down results in an answer of $4028. Check for accuracy by adding again—this time from the bottom up. If the answers are the same, the sum is probably correct. If the answers are different, there is an error in either adding down or adding up, and the problem should be reworked. Both answers agree in this example, so the sum is correct.

QUICK CHECK 3

Find the total of the following expenses: $2805 + $871 + $28 + $169 + $1196

OBJECTIVE 4 Round numbers to estimate an answer. Answers can be quickly estimated using **front-end rounding**. This requires the first number to be rounded and all the following digits to be changed to zero. Only one nonzero digit remains.

Using Front-end Rounding to Estimate an Answer   **EXAMPLE 4**

The graphic shows the top oil producing areas in the U.S. Notice that a lot of oil is produced offshore in the Gulf of Mexico. Apply front-end rounding to estimate total oil production from these areas.
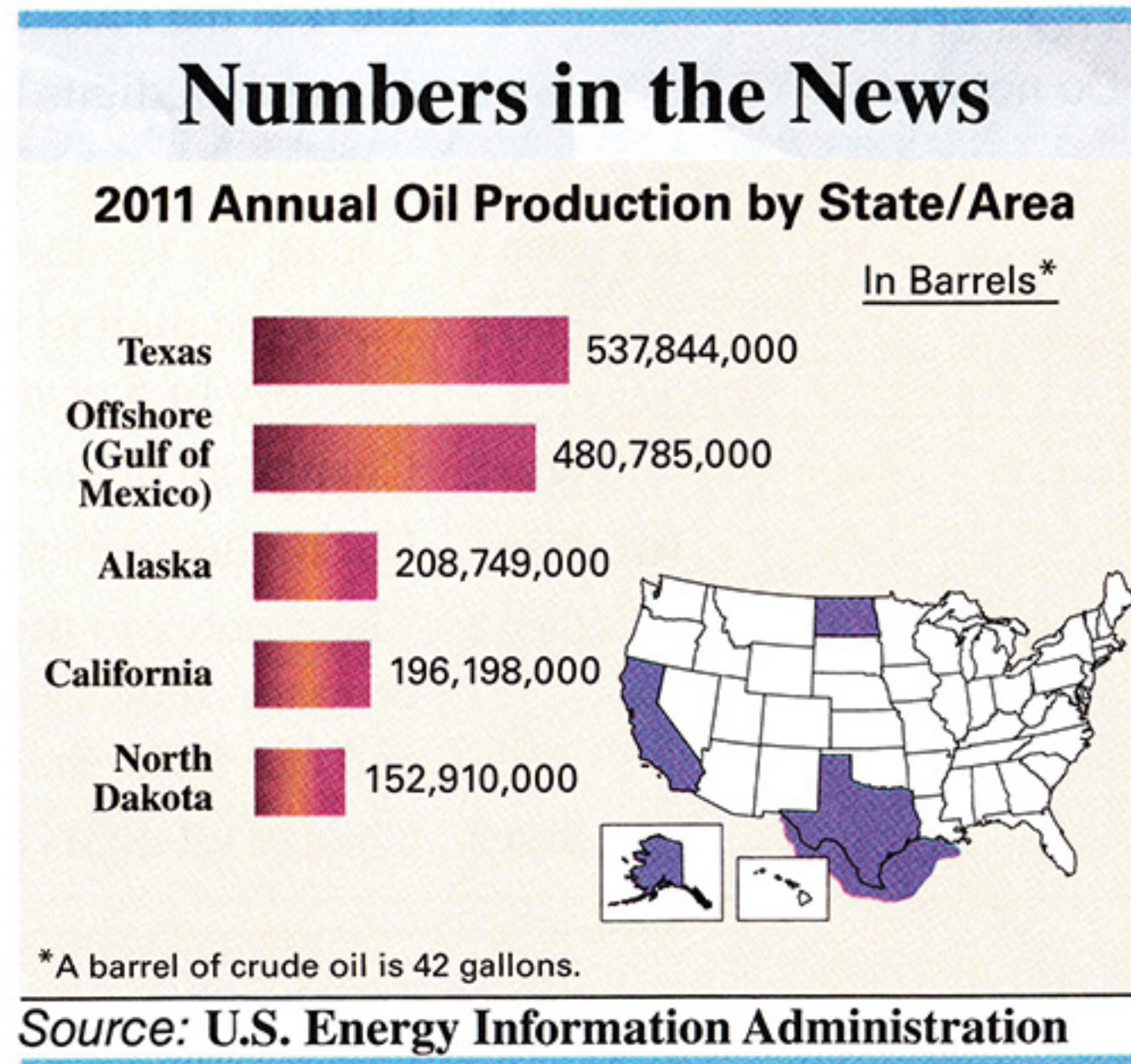
Numbers in the News

2011 Annual Oil Production by State/Area

In Barrels*

Texas	537,844,000
Offshore (Gulf of Mexico)	480,785,000
Alaska	208,749,000
California	196,198,000
North Dakota	152,910,000

*A barrel of crude oil is 42 gallons.

Source: U.S. Energy Information Administration

SOLUTION

	Actual		Front-end Rounded
Texas	537,844,000	→	500,000,000
Offshore (Gulf)	480,785,000	→	500,000,000
Alaska	208,749,000	→	200,000,000
California	196,198,000	→	200,000,000
North Dakota	152,910,000	→	200,000,000
	Estimated Total		1,600,000,000 barrels of oil

Oil consumption in the U.S. is about 7,000,000,000 barrels. The U.S. must buy the difference between what is consumed and what is produced in the U.S. It buys oil from Canada, Saudi Arabia and other oil exporting nations.

OBJECTIVE 5 Subtract whole numbers. A subtraction problem is set up much like an addition problem. The top number is the **minuend**, the number being subtracted is the **subtrahend**, and the answer is the **difference**.

$$
\begin{array}{r}
23 \\
- \ 7 \\
\hline
16
\end{array}
\quad
\begin{array}{l}
\text{minuend} \\
\text{subtrahend} \\
\text{difference}
\end{array}
$$

Subtract one number from another by placing the subtrahend directly under the minuend with columns aligned. Begin the subtraction from the right-most column. When a digit in the subtrahend is *larger* than the corresponding digit in the minuend, **borrow** as shown in the next example.

Subtracting with Borrowing

EXAMPLE 5

Subtract 2894 SUBWAY drink cups from 3783 SUBWAY drink cups in inventory. First, write the problem as follows.

$$
\begin{array}{r}
3783 \\
-2894
\end{array}
$$

In the ones (units) column, subtract 4 from 3 by borrowing a 1 from the tens column in the minuend to get 1 ten + 3, or 13, in the units column with 7 now in the tens column. Then subtract 4 from 13 for a result of 9. Complete the subtraction as follows.

$$
\begin{array}{r}
2 \quad 16 \quad 17 \quad 13 \\
\cancel{3} \quad \cancel{7} \quad \cancel{8} \quad \cancel{3} \\
- \ 2 \quad \ 8 \quad \ 9 \quad \ 4 \\
\hline
8 \quad \ 8 \quad \ 9
\end{array}
\quad \text{drink cups}
$$

In this example, the tens are borrowed from the hundreds column, and the hundreds are borrowed from the thousands column.

Check the answer to a subtraction problem by adding the answer (difference) to the subtrahend. The result should equal the minuend.

Subtracting with Checking

EXAMPLE 6

Subtract 1635 from 5383 and check the answer.

Quick TIP

Do not change the order of the numbers when subtracting. For example, $(9 - 5)$ is not the same thing as $(5 - 9)$.

Problem

$$
\begin{array}{r}
\text{Problem} \\
\text{(subtract down)} \downarrow
\end{array}
\begin{array}{r}
5383 \\
- \ 1635 \\
\hline
3748
\end{array}
\begin{array}{l}
\text{minuend} \\
\text{subtrahend} \\
\text{difference}
\end{array}
$$

Check

$$
\begin{array}{r}
5383 \\
+ \ 1635 \\
\hline
3748
\end{array}
\ \uparrow \ \text{This result should equal the minuend.}
$$

Check (add up)

OBJECTIVE 6 Multiply whole numbers. Multiplication is actually a quick method of addition. For example, 3×4 can be found by adding 3 a total of 4 times, since 3×4 means $3 + 3 + 3 + 3 = 12$. However, it is not practical to use the addition method for large numbers. For example, 103×92 would be found by adding 103 a total of 92 times. Instead, find

this result with multiplication. The multiplication of 103 by 92 can be written in any of the following ways:

$$103 \times 92 = 103 \cdot 92 = 103 \cdot 92 = (103)(92)$$

The number being multiplied is the **multiplicand**, the number doing the multiplying is the **multiplier**, and the answer is the **product**.

$$
\begin{array}{rl}
3 & \text{multiplicand} \\
\times\ 4 & \text{multiplier} \\
\hline
12 & \text{product}
\end{array}
$$

When the multiplier contains more than one digit, **partial products** must be used, as in the next example, which shows the product of 25 and 34.

Multiplying Whole Numbers

EXAMPLE 7

Multiply 25×34 by first multiplying 25 by the 4 in the ones place as shown in Step 1. Then multiply 25 by 3 in the tens place as shown in Step 2, before adding to find the answer in Step 3.

Problem	Step 1	Step 2	Step 3	
25	25	25	25	multiplicand
× 34	× 34	× 34	× 34	multiplier
	100	100	100	partial product (25×4)
		75	+ 75	partial product (25×3)
			850	product

Step 1   Multiply 25 by 4 and write 100 aligning ones places.

Step 2   Multiply 25 by 3 and write 75 one position to the left since 3 is in the tenths place. The 5 in 75 will be in the ten's place.

Step 3   Add the two partial products to get the answer.

QUICK CHECK 7

Multiply 18 telemarketers by 36 phone calls per telemarketer per hour to estimate the number of calls made in one hour.

OBJECTIVE 7   Multiply by omitting zeros. If the multiplier or multiplicand end in zero, first omit any zeros at the right of the numbers and then replace omitted zeros at the right of the final answer. For example, find the product of 240 and 13 as follows.

$$
\begin{array}{rl}
240 & \text{Omit the zero in the calculation.} \\
\times\ 13 & \\
\hline
72 & \\
24 & \\
\hline
3120 & \text{Replace the omitted zero at the right of} \\
& \text{312 for a final answer (product) of 3120.}
\end{array}
$$

Multiplying, Omitting Zeros

EXAMPLE 8

In the following multiplication problems, omit zeros in the calculation and then replace omitted zeros to obtain the product.

(a)
$$
\begin{array}{rr}
150 & 15 \quad \leftarrow \text{omit zeros} \\
\times\ 70 & \times\ 7 \\
\hline
& 105 \quad \textbf{attach 2 zeros} \\
& 10{,}500 \quad \text{answer}
\end{array}
$$

(b)
$$
\begin{array}{rr}
300 & 3 \quad \leftarrow \text{omit zeros} \\
\times\ 90 & \times\ 9 \\
\hline
& 27 \quad \textbf{attach 3 zeros} \\
& 27{,}000 \quad \text{answer}
\end{array}
$$

QUICK CHECK 8

Multiply 400 by 50. Omit zeros in the calculation and replace them in the product.

Quick TIP

A shortcut for multiplying by 10, 100, 1000, and so on is to just attach the number of zeros to the number being multiplied. For example,

$$33 \times 10 = 33 \text{ and } \textbf{1} \text{ zero } = 330$$
$$56 \times 100 = 56 \text{ and } \textbf{2} \text{ zeros} = 5600$$
$$732 \times 1000 = 732 \text{ and } \textbf{3} \text{ zeros} = 732{,}000$$

OBJECTIVE 8 Divide whole numbers. The **dividend** is the number being divided, the **divisor** is the number doing the dividing, and the **quotient** is the answer. **Division** is indicated in any of the following ways.

$$\underset{\text{dividend}}{15} \div \underset{\text{divisor}}{5} = \underset{\text{quotient}}{3} \qquad \underset{\text{divisor}}{5} \overline{)\underset{\text{dividend}}{15}} \, \overset{3}{}\, \text{\small quotient}$$

$$\underset{\text{divisor}}{\overset{\text{dividend}}{\frac{15}{5}}} = 3 \text{ \small quotient}$$

Dividing Whole Numbers | **EXAMPLE 9**

To divide 1095 baseball cards evenly among 73 collectors, divide 1095 by 73 as follows.

$$73\overline{)1095}$$

Since 73 is larger than 1 or 10, but smaller than 109, begin by dividing 73 into 109. There is one 73 in 109, so place 1 *over the digit 9* in the dividend as shown. Then multiply 1 and 73.

$$\begin{array}{r} 1 \\ 73\overline{)1095} \\ \underline{73} \qquad 1 \times 73 = 73 \\ 36 \end{array}$$

Subtract 73 from 109 to get 36. The next step is to bring down the 5 from the dividend, placing it next to the remainder 36. This gives the number 365. The divisor, 73, is then divided into 365 with a result of 5, which is placed to the right of the 1 in the quotient. Since 73 divides into 365 exactly 5 times, the final answer (quotient) is exactly 15.

$$\begin{array}{r} 15 \\ 73\overline{)1095} \\ \underline{73} \\ 365 \\ \underline{365} \\ 0 \end{array}$$

Check the answer by multiplying.

$$\begin{array}{r} 73 \\ \times\ 15 \\ \hline 365 \\ 73 \\ \hline 1095 \end{array}$$ **Since this is the original number of cards, the answer checks.**

QUICK CHECK 9

Divide $7506 evenly among 18 winners. How much will each receive?

Often, the divisor does not divide evenly into the dividend, leaving a remainder. The next example shows that remainders can be also be written using fractions or decimals. Fractions and decimals are covered in the next chapter. For now, write a remainder of 6 as R6.

Dividing with a Remainder in the Answer   **EXAMPLE 10**   Divide 126 by 24. Express the remainder in each of the three forms.

Remainder	Fraction	Decimal
5 R6	$5\frac{6}{24}$	5.25
24$\overline{)126}$	24$\overline{)126}$	24$\overline{)126.00}$
$\underline{120}$	$\underline{120}$	$\underline{120}$
6	6	6 0
		$\underline{4\ 8}$
		1 20
		$\underline{1\ 20}$
		0

QUICK CHECK 10

Divide 19 by 5.

If a divisor contains zeros at the far right, first drop the zeros in the divisor and then move the decimal point in the dividend the same number of places to the left as there were zeros dropped from the divisor.

900$\overline{)108,000}$ becomes   9$\overline{)1080}$

Drop 2 zeros. ⟍   ⟋ Move decimal point 2 places left.

Dropping Zeros to Divide   **EXAMPLE 11**   To divide 108,000 by 900, first drop two zeros from each number. Then divide.

$$\begin{array}{r} 120 \\ 9\overline{)1080} \\ \underline{9} \\ 18 \\ \underline{18} \\ 0 \\ \underline{0} \end{array}$$

Check Answer

$$\begin{array}{r} 120 \\ \times\ 9 \\ \hline 1080 \end{array}$$ so the division is correct

You must change 9 back to 900 and multiply by 120 to get the original dividend of 108,000.

Therefore, 108,000 ÷ 900 = 120.

> **Quick TIP**
>
> After dropping zeros and dividing, do not add trailing zeros back to the answer.

QUICK CHECK 11

First drop zeros, and then divide 19,200 ÷ 300.

Checking Division Problems with Remainders   **EXAMPLE 12**   In a division problem, check the answer by multiplying the quotient (answer) and the divisor. Then add any remainder. If the result is not the same as the dividend, an error exists and the problem should be reworked. Check the following division problems.

(a)
$$\begin{array}{r} 37\ R3 \\ 716\overline{)26,495} \\ \underline{21\ 48} \\ 5\ 015 \\ \underline{5\ 012} \\ 3 \end{array}$$ remainder

(b)
$$\begin{array}{r} 85\ R6 \\ 418\overline{)35,536} \\ \underline{33\ 44} \\ 2\ 096 \\ \underline{2\ 090} \\ 6 \end{array}$$ remainder

SOLUTION

Quick TIP
Be sure to add the remainder to the product when checking a division problems with a remainder.

(a)
```
     716
  ×   37
    5012
    2148
  26,492
  +    3    add remainder
  26,495    correct
```

(b)
```
     418
  ×   85
    2090
    3344
  35,530
  +    6    add remainder
  35,536    correct
```

QUICK CHECK 12

Divide 9897 by 215. Check the answer by multiplying the quotient (answer) by the divisor.

▼ 1.1 Exercises

MyMathLab®

*The shaded sections below contain solutions to help you get a **QUICK START** on the various types of exercises.*

Write the following numbers in words. (See Example 1.)

1. 7040 seven thousand, forty

2. 5310 five thousand, three hundred ten

3. 37,901 _____

4. 725,069 _____

5. 4,650,015 _____

6. 3,765,041,000 _____

*Round each of the following numbers first to the nearest ten, then to the nearest hundred, and finally to the nearest thousand. Go back to the **original number** each time before rounding to the next position. (See Example 2.)*

	Nearest Ten	Nearest Hundred	Nearest Thousand
7. 2065	2070	2100	2000
8. 8385	8390	8400	8000
9. 46,231	_____	_____	_____
10. 55,175	_____	_____	_____
11. 106,054	_____	_____	_____
12. 359,874	_____	_____	_____

13. Explain the three steps needed to round a number when the digit to the right of the place to which you are rounding is 5 or more. (See Objective 2.)

14. Explain the three steps needed to round a number when the digit to the right of the place to which you are rounding is 4 or less. (See Objective 2.)

indicates an exercise that is related to the Case in Point feature.

Add each of the following. Check your answers. (See Example 3.)

15.	75	16.	57	17.	875	18.	135
	63		26		364		594
	45		43		171		415
	+ 27		+ 18		+ 776		+ 276
	210						

19.	750	20.	371	21.	311,479	22.	803,526
	91		45		77,631		759,991
	8		839		+ 594,383		+ 36,024
	540		3				
	+ 7		+ 47				

Subtract each of the following. Check your answers. (See Examples 5 and 6.)

23.	896	24.	757	25.	3715	26.	6215
	− 228		− 286		− 838		− 767

27.	65,198	28.	445,193	29.	7,025,389	30.	9,807,943
	− 43,652		− 62,785		− 936,490		− 959,489

Solve the following problems. To serve as a check, the vertical and horizontal totals must be the same in the lower right-hand corner.

31. PRODUCT PURCHASES   The following table shows monthly purchases at a Best Buy by product line for each of the first six months of the year. Complete the totals by adding horizontally and vertically.

Product	Jan.	Feb.	Mar.	Apr.	May	June	Totals
Software	$49,802	$36,911	$47,851	$54,732	$29,852	$74,119	**$293,267**
Computers	$86,154	$72,908	$31,552	$74,944	$85,532	$36,705	
Printers	$59,854	$85,119	$87,914	$45,812	$56,314	$91,856	
Mobile Phones	$73,951	$72,564	$39,615	$71,099	$72,918	$42,953	
Totals							

32. DEPARTMENT SALES   The following table shows Jameson's Fashion expenses by department for the last six months of the year. Complete the totals by adding horizontally and vertically.

Department	July	Aug.	Sept.	Oct.	Nov.	Dec.	Totals
Office	$29,806	$31,712	$40,909	$32,514	$18,902	$23,514	
Production	$92,143	$86,599	$97,194	$72,815	$89,500	$63,754	
Sales	$31,802	$39,515	$58,192	$32,544	$41,920	$48,732	
Warehouse	$15,746	$12,986	$32,325	$41,983	$39,814	$20,605	
Totals							

Multiply each of the following. (See Example 7.)

33.
```
   218
 × 43
  654
  872
 9374
```

34.
```
   672
 × 56
```

35.
```
  1896
 × 62
```

36.
```
  7318
 × 38
```

37.
```
  6452
 × 263
```

38.
```
  7143
 × 295
```

39.
```
  1109
 × 7311
```

40.
```
  9503
 × 3411
```

Estimate answers using front-end rounding. Then find the exact answers. (See Example 4.)

41.
Estimate		Exact
8000	←rounds	8215
60	←to	56
700	←	729
+ 4000	←	+ 3605
12,760		12,605

42.
Estimate		Exact
	←	2685
	←	73
	←	592
+	←	+ 7183

43.
Estimate		Exact
	←	783
−	←	− 238

44.
Estimate		Exact
	←	942
−	←	− 286

45.
Estimate		Exact
	←	638
×	←	× 47

46.
Estimate		Exact
	←	864
×	←	× 74

Multiply, omitting zeros in the calculation and then replacing them at the right of the product to obtain the final answer. (See Example 8.)

47.
```
   370
 × 180
   37
 × 18
  666    2 zeros
 66,600
```

48.
```
   520
 × 400
```

49.
```
  3760
 × 6000
```

50.
```
  7200
 × 1300
```

Divide each of the following. (See Examples 9 and 10.)

51.
```
       1241 R1
    4)4965
      4
      09
       8
      16
      16
       05
        4
        1
```

52. 7)13,214

53. 43)19,715

54. 93)81,452

55. Explain why checking the answer is a very important step in solving math problems.

56. In your personal and business life, when is it most important to check your math calculations? Why?

Divide each of the following, dropping zeros from the divisor. (See Examples 10 and 11.)

57. $180)\overline{429,350}$ **58.** $320)\overline{360,990}$ **59.** $1300)\overline{75,800}$ **60.** $1600)\overline{253,100}$

$$
\begin{array}{r}
2\ 385\ \text{R}5 \\
18)\overline{42,935} \\
\underline{36} \\
6\ 9 \\
\underline{5\ 4} \\
153 \\
\underline{144} \\
95 \\
\underline{90} \\
5
\end{array}
$$

Rewrite the following numbers in words. (See Example 1.)

61. **MOTAR VEHICLE ACCIDENTS**   According to the NHTSA, the number of people injured in accidents in 2011 was 2,240,000.

62. **WOMEN IN BUSINESS**   A.G. Edwards reports that there are 8,534,350 businesses owned by women in the United States.

63. **PARACHUTE JUMPS**   There are 3,200,000 parachute jumps in the United States each year according to the History Channel.

64. **GROSS NATIONAL PRODUCT**   The market value of goods and services created in the U.S. increased last quarter to $15,461,800,000,000.

Rewrite the numbers from the following sentences using digits. (See Example 1.)

65. **JELL-O SALES**   The average number of boxes of Jell-O gelatin sold each day is eight hundred fifty-four thousand, seven hundred ninety-five. (*Source:* Kraft Foods.)

65. 854,795 boxes _____

66. **CRAYON SALES**   The Binney & Smith Company makes about two billion Crayola Crayons each year.

66. _____

67. **SALVATION ARMY**   During the past year, the Salvation Army served fifty-five million, five hundred seventy-two thousand, six hundred thirty-three meals to hungry men, women, and children.

67. _____

68. **HURRICANE KATRINA**   At a New Orleans pumping station, one of the pumps designed by Alexander Baldwin Wood pumped six hundred forty-eight million gallons of flood water (7500 gallons per second) in one day.

68. _____

Solve the following application problems.

69. HERSHEY MINI CHIPS A student estimated that there are approximately 5000 Mini Chips semisweet chocolate chips in 1 pound. How many chips are in 40 pounds?

5 × 4 = 20   4 zeros
↙
200,000

69. 200,000 chips
_____

70. HERSHEY KISSES Each day 33,000,000 Hershey Kisses can be produced. Find the number of Hershey Kisses that can be produced in 30 days.

70. _____

71. CAMPUS VENDING MACHINES On a normal weekday, the vending machines at American River College dispense 900 sodas, 400 candy bars, 500 snack items, and 200 cups of coffee. If it takes Jim Wilson four hours to restock the vending machines, how many items does he restock each hour?

71. _____

72. IPAD SALES The numbers of iPads sold weekly in one city were 1801, 927, 2088, 580, and 1049. Find the average number sold per week.

72. _____

WHITE WATER RAFTING *American River Raft Rentals lists the following daily raft rental fees. Notice that there is an additional $3 launch fee payable to the park system for each raft rented. Use this information to solve Exercises 73 and 74.*

American River Raft Rentals		
Size	Rental Fee	Launch Fee
4 persons	$70	$3
6 persons	$95	$3
10 persons	$165	$3
12 persons	$180	$3

73. On a recent Sunday, the following rafts were rented: 6 4-person rafts, 15 6-person rafts, 10 10-person rafts, and 5 12-person rafts. Find the total receipts, including the $3-per-raft launch fee.

73. _____

74. During the July 4th weekend, the following rafts were rented: 38 4-person rafts, 73 6-person rafts, 58 10-person rafts, and 46 12-person rafts. Find the total receipts including the $3-per-raft launch fee.

74. _____

EGG PRODUCTION *The following pictograph shows the states with the largest number of egg-laying chickens. Use this information to answer Exercises 75–78.*

Numbers in the News

Top Egg-Laying States in 2012
(thousands of chickens)

Iowa	51,062
Ohio	27,870
Pennsylvania	24,912
Indiana	24,353
California	20,024
Texas	18,769

Source: **National Agricultural Statistics Service**
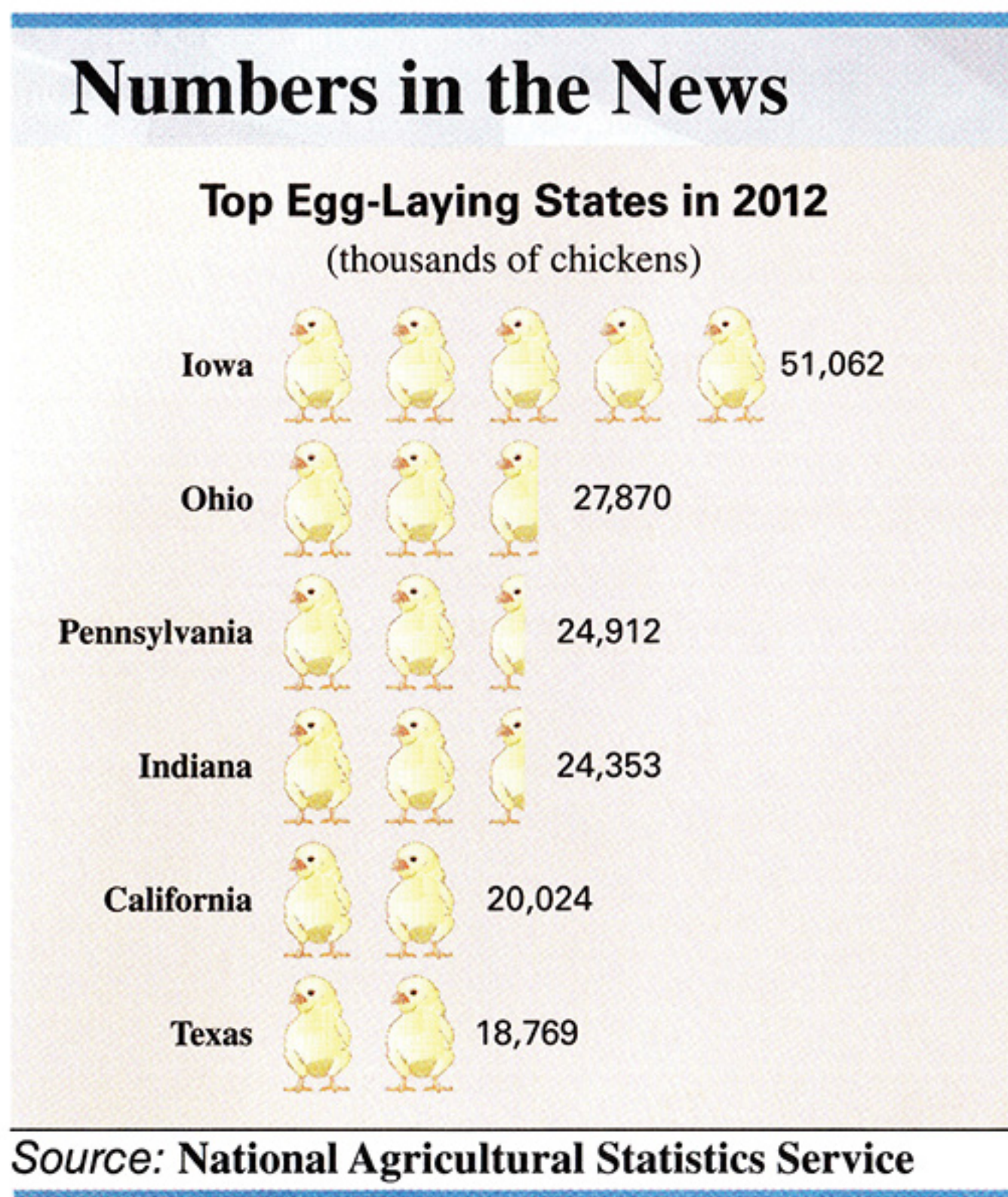
75. Find the number of egg-laying chickens in the top four states.
$51{,}062 + 27{,}870 + 24{,}912 + 24{,}353 = 128{,}197$ thousand or 128,197,000

75. 128,197 thousand or 128,197,000

76. Use front-end rounding to estimate the total number of egg-laying chickens from all states shown.

76. _____

77. How many more egg-laying chickens are there in Iowa than in Texas?

77. _____

78. How many more egg-laying chickens are there in Iowa and Ohio combined compared to California and Texas combined?

78. _____

RETAIL GIANTS *The following pictograph shows the number of retail stores worldwide for the seven companies with the greatest number of outlets. Use the pictograph to answer Exercises 79–84.*

Numbers in the News

The Retail Giants

Company	
Dollar General	
Wal-Mart	
7-Eleven	
CVS	
Family Dollar	
Walgreens	
Rite-Aid	

🛒 = 1000 stores

Source: **Company Web sites.**

79. Find the number of Family Dollar retail stores.
$6.5 \times 1000 = 6500$ stores

79. 6500 stores

80. Estimate the number of stores for 7-Eleven.

80. _____

81. Which company has the largest number of retail stores? How many does it have?

81. _____

82. Which of the seven retailers has the fewest number of retail stores? How many does it have?

82. _____

83. How many more retail stores does Dollar General have than Walgreens?

83. _____

84. How many more stores does CVS have compared to its competitor Walgreens?

84. _____

QUICK CHECK ANSWERS

1. Sixteen trillion, eight hundred ten billion, six hundred eighty million, three hundred ninety-one thousand, five hundred forty
2. (a) 650,000, (b) 7,000,000, (c) 499,000 (d) 500,000
3. $5069
4. 1,080,000
5. 1679 customers
6. 1791
7. 648 phone calls
8. 20 attach 3 zeros = 20,000
9. $417
10. 3 R4
11. 64
12. 46 R7

1.2 Application Problems

OBJECTIVES

1 Find indicator words in application problems.

2 Learn the four steps for solving application problems.

3 Learn to estimate answers.

4 Solve application problems.

When Jessica Fernandez became a manager at a SUBWAY store, she had to brush up on her math skills. She remembered that certain words indicate addition, subtraction, multiplication, and division.

Many business-application problems require mathematics. You must read very carefully to decide how to solve the problem.

OBJECTIVE 1 Find indicator words in application problems. Look for **indicator words** in the application problem—words that indicate the necessary operations: addition, subtraction, multiplication, or division. Some of these words appear below.

Addition	Subtraction	Multiplication	Division	Equals
plus	less	product	divided by	is
more	subtract	double	divided into	the same as
more than	subtracted from	triple	quotient	equals
added to	difference	times	goes into	equal to
increased by	less than	of	divide	yields
sum	fewer	twice	divided equally	results in
total	decreased by	twice as much	per	are
sum of	loss of			
increase of	minus			
gain of	take away			
	reduced by			

The word *and* is not listed above since it can have many different meanings, including all the following:

1. sum of 3 **and** 4,
2. product of 6 **and** 8,
3. seventeen **and** one-half, or
4. six **and** seven tenths.

OBJECTIVE 2 Learn the four steps for solving application problems. When working difficult problems, try to take your time and relax as if you were at the gym or a pool. Believe it or not, you are training your brain when working problems. It is okay if you do NOT know how to solve a problem when first reading it.

Quick TIP

Do NOT make the mistake that some students do, which is to try and solve a problem before knowing what is being asked.

Solving Application Problems

Step 1   Read the problem carefully, two or three times if needed. Be sure that you understand what is being asked.

Step 2   Identify given facts and *look for indicator words*. Then work out a plan to solve the problem.

Step 3   Estimate a *reasonable answer* using rounding.

Step 4   Solve the problem. Does the answer make sense? If not, work it again.

OBJECTIVE 3 Learn to estimate answers. Each of the steps in solving an application problem is important, but special emphasis should be placed on step 3, estimating a reasonable answer. Many times an answer just *does not fit* the problem.

What is a *reasonable answer*? Read the problem and estimate the approximate size of the answer. Should the answer be part of a dollar, a few dollars, hundreds, thousands, or even millions of dollars? For example, if a problem asks for the retail price of a shirt, would an answer of $20 be reasonable? $1000? $.65? $65?

Always make an estimate of a reasonable answer. Always look at the answer and decide if it is reasonable. These steps will give greater success in problem solving.

Using Word Indicators to Help Solve a Problem

EXAMPLE 1

Total sales at a neighborhood yard sale were $3584. The money was divided equally among the boys soccer club, the girls soccer club, the boys softball team, and the girls softball team. How much did each group receive?

SOLUTION

Sales of $3584 are to be *divided equally* among the four groups. Estimate the answer by first rounding $3584 to the nearest hundred ($3600); then divide by 4.

$$\$3600 \div 4 = \$900 \qquad \text{\textcolor{blue}{estimate of amount to each group}}$$

Divide to find the exact answer.

$$\begin{array}{r} \$896 \\ 4\overline{)3584} \\ \underline{32} \\ 38 \\ \underline{36} \\ 24 \\ \underline{24} \\ 0 \end{array}$$

Check Work

$$\begin{array}{r} \$896 \\ \times 4 \\ \hline \$3584 \end{array}$$

The answer is correct.

Each group should get $896.

QUICK CHECK 1

A library budget surplus of $13,280 is divided evenly among four branch libraries. How much did each receive?

OBJECTIVE 4   Solve application problems. To improve your accuracy, use the four steps and estimate answers when solving application problems.

Solving an Application Problem

EXAMPLE 2

The daily sales figures at a SUBWAY RESTAURANT were $2358 on Monday, $3056 on Tuesday, $2515 on Wednesday, $1875 on Thursday, $3978 on Friday, $3219 on Saturday, and $3008 on Sunday. Find the total sales for the week.

SOLUTION

▼ CASE IN POINT   The sales for each day are given, and the total sales are needed. The word indicators *total sales* tell you to add the daily sales to arrive at the weekly total. Since the sales are about $3000 each day for a week of 7 days, a reasonable estimate would be around $21,000 (7 × $3000 = $21,000). Find the actual answer by adding the sales for each of the 7 days.

$$\begin{array}{r} \textbf{\$20,009} \\ \hline \$2358 \\ \$3056 \\ \$2515 \\ \$1875 \\ \$3978 \\ \$3219 \\ + \ \$3008 \\ \hline \$20,009 \end{array}$$

Add.   **Check**

$20,009 sales for the week

The answer of $20,009 is reasonable.

QUICK CHECK 2

The numbers of visitors to a war veterans' memorial during one week are 5318, 2865, 4786, 1898, 3899, 2343, and 7221. First estimate the total attendance for the week. Then calculate exactly.
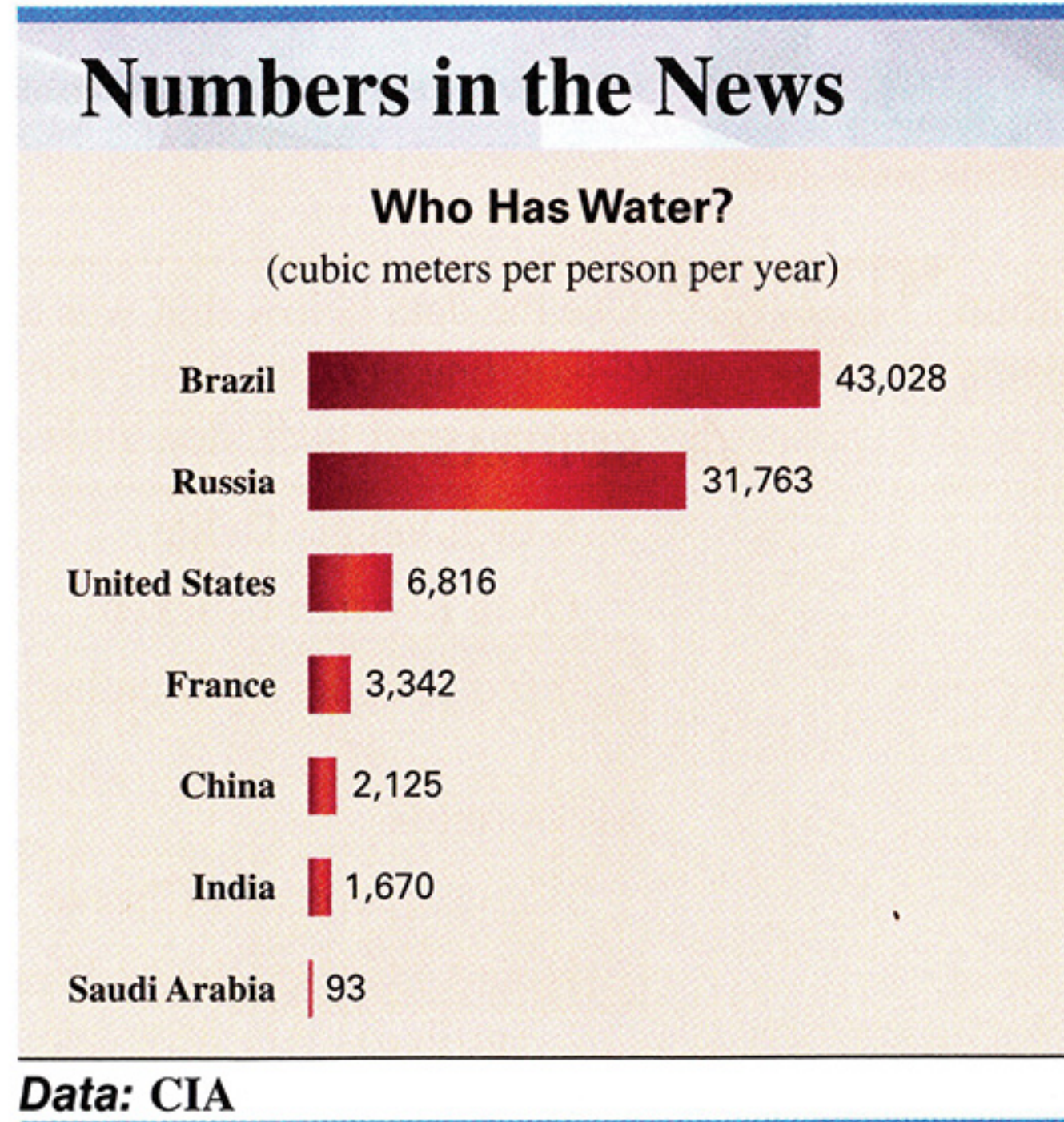
Solving an Application Problem

Many experts believe that water shortages will soon be a major problem. The chart below shows an estimate of fresh water resources per person, by country.

(a) Find the difference in the water resources per person between China and India.

(b) Use division to compare water per person in the United States to that in India.

Water Shortages in India

Numbers in the News

Who Has Water?
(cubic meters per person per year)

Country	
Brazil	43,028
Russia	31,763
United States	6,816
France	3,342
China	2,125
India	1,670
Saudi Arabia	93

Data: CIA

(a) The indicator word *difference* suggests a subtraction problem.

$$\begin{array}{r} 2125 \\ -\ 1670 \\ \hline 455 \end{array}$$ cubic meters per person per year

(b) $6816 \div 1670 = 4.08$ (rounded), or about 4 times as much water per person in the United States as in India.

Note that the figure suggests nothing about the geographic distribution of water within a country or whether the water is clean enough for human consumption. Clearly, some countries have far fewer water resources than others. In addition, water pollution is a terrible problem in many poor countries.

QUICK CHECK 3

Find the difference in the water resources per person between Brazil and Saudi Arabia.

Solving a Two-Step Problem

In May, the landlord of an apartment building received $940 from each of eight tenants. After paying $2730 in expenses, how much money did the landlord have left?

SOLUTION

Multiply the amount of rent by the number of tenants to arrive at the monthly income. Since the rent is about $900 and there are eight tenants, a *reasonable estimate* would be around $7200 ($900 × 8 = $7200).

$$\begin{array}{r} \$940 \\ \times\ \ \ 8 \\ \hline \$7520 \end{array}$$ monthly income (this is reasonable)

Now subtract the expenses from the monthly income.

$$\begin{array}{r} \$7520 \\ -\ 2730 \\ \hline \$4790 \end{array}$$ amount remaining

QUICK CHECK 4

A homeowner's association collected $385 from each of 62 homeowners. If the association paid $18,280 in expenses, how much remained?

SUBWAY promotes healthy, low-fat food choices and fresh vegetables. Perhaps you have seen the SUBWAY advertising featuring Jared Fogle. As a college student, he weighed 425 pounds. By eating just two (a 6-inch and a foot-long) SUBWAY sandwiches each day, he lost 225 pounds in one year. However, other fast-food chains such as McDonalds also now offer items with fewer calories and less fat as shown in the next example.

Solving Application Problems

EXAMPLE 5

Use the data below that was taken from company websites to answer each question.

SUBWAY	Calories	Total Fat (gms)
6-inch Veggie Delite	230	2.5
Oven Roasted Chicken	320	5.0
6-inch Pepperoni Meatball Melt	600	29.0

McDonalds		
Angus Bacon and Cheese	790	39
Honey Mustard Snack Wrap (grilled)	250	8
Premium Southwest Salad (grilled chicken)	290	8

(a) How many fewer calories and grams of fat are in a 6-inch Veggies Delite Sandwich (SUBWAY) compared to an Angus Bacon and Cheese sandwich (McDonalds)?

(b) How many fewer calories and grams of fat are in a Premium Southwest Salad with grilled chicken (McDonalds) compared to a 6-inch Pepperoni Meatball Melt (SUBWAY)?

SOLUTION

(a) The indicator word fewer suggests subtraction should be used.

$$\begin{array}{r} 790 \\ -\ 230 \\ \hline \mathbf{560}\text{ fewer calories} \end{array} \qquad \begin{array}{r} 39 \\ -\ 2.5 \\ \hline \mathbf{36.5}\text{ fewer grams of fat} \end{array}$$

(b)
$$\begin{array}{r} 600 \\ -\ 290 \\ \hline \mathbf{310}\text{ fewer calories} \end{array} \qquad \begin{array}{r} 29 \\ -\ 8 \\ \hline \mathbf{21}\text{ fewer grams of fat} \end{array}$$

QUICK CHECK 5

From the information given above, find the total calories and grams of fat if an individual eats both a Honey Mustard Snack Wrap (grilled) and a Premium Southwest Salad (grilled chicken) from McDonalds.

1.2 Exercises

MyMathLab®

The shaded sections below contain solutions to help you get a **QUICK START** *on the various types of exercises.*

Solve the following application problems.

1. SUBWAY SANDWICHES Last week, SUBWAY sold 602 Veggie Delite sandwiches, 935 ham sandwiches, 1328 turkey breast sandwiches, 757 roast beef sandwiches, and 1586 SUBWAY Club sandwiches. Find the total number of sandwiches sold.

602 + 935 + 1328 + 757 + 1586 = 5208 sandwiches

1. **5208 sandwiches**

2. **COMPETITIVE CYCLIST TRAINING** During a week of training, Rob Andrews rode his bike 80 miles on Monday, 75 miles on Tuesday, 135 miles on Wednesday, 40 miles on Thursday, and 52 miles on Friday. What is the total number of miles he rode in the five-day period?
Total miles traveled = 80 + 75 + 135 + 40 + 52 = 382 miles

2. **382 miles**

3. **MILES DRIVEN** The Federal Highway Administration estimates that total miles driven fell from 3020 billion miles last year to 2920 billion miles this year due to the recession. Find the reduction in miles driven.

3. _____

4. **SUV SALES** In a recent three-month period, there were 81,465 Ford Explorers and 70,449 Jeep Grand Cherokees sold. How many more Ford Explorers were sold than Jeep Grand Cherokees? (*Source*: J. D. Power and Associates.)

4. _____

5. **WORLD WAR II VETERANS** According to the Department of Veterans Affairs, U.S. World War II veterans are dying at the rate of 607 per day. How many World War II veterans are projected to die in the next 365 days? (*Source*: Department of Veteran's Affairs.)

5. _____

6. **TOTAL WORLD WAR II VETERANS** According to the Department of Veterans Affairs, there are roughly 1,100,000 U.S. World War II veterans alive today. If only 1 in 16 is still alive, find the total number who were World War II veterans. (*Source*: Department of Veteran's Affairs.)

6. _____

7. **FISHING BOAT** A fishing boat weighs 8375 pounds. If its 762-pound engine is removed and replaced with a 976-pound engine, find the weight of the boat after the engine change.

7. _____

8. **COLLEGE TEXTBOOKS** Tatum Palmer needs to buy three textbooks this semester and shops first at her college bookstore. The cost of new books are: $195, $180, and $205. The cost of used books are: $85, $62, and $92. Find the savings if she buys all three books used.

8. _____

9. **NOTEBOOK** The price of a mini notebook was lowered from $499 to $435. Find the decrease in price.

9. _____

10. **WEIGHING FREIGHT** A truck weighs 9250 pounds when empty. After being loaded with firewood, the truck weighs 21,375 pounds. What is the weight of the firewood?

10. _____

11. **LAND AREA** There are 43,560 square feet in 1 acre. How many square feet are there in 140 acres?

11. _____

12. **CHECK PROCESSING** Bank of America processes 40 million checks each day. Find the number of checks processed by the bank in a year. (Use a 365-day year.)

12. _____

13. **HOTEL ROOM COSTS** In a recent study of hotel–casinos, the cost per night at Harrah's Reno was $75, while the cost at Harrah's Lake Tahoe was $225 per night. Find the amount saved on a seven-night stay at Harrah's Reno instead of staying at Harrah's Lake Tahoe.

13. _____

Indicates an exercise that is related to the Case in Point feature.

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