GLOBAL EDITION

Business Mathematics

THIRTEENTH EDITION

Gary Clendenen • Stanley A. Salzman

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Business Mathematics

Business Mathematics

THIRTEENTH EDITION

GLOBAL EDITION

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Contents

Preface 8
The Business Mathematics, 13th Edition, Learning System 9
Learning Tips for Students 14
Business Mathematics Pretest 15
Index of Applications 16

Chapter 1
Whole Numbers and Decimals 21

1.1 Whole Numbers 22
1.2 Application Problems 35
1.3 Decimal Numbers 41
1.4 Addition and Subtraction of Decimals 45
1.5 Multiplication and Division of Decimals 49
Chapter 1 Quick Review 57
Chapter Terms 57
Case Study: Cost of Getting Married 59
Case in Point Summary Exercise: Subway 60
Chapter 1 Test 61

Chapter 2
Fractions 63

2.1 Fractions 64
2.2 Addition and Subtraction of Fractions 70
2.3 Addition and Subtraction of Mixed Numbers 78
2.4 Multiplication and Division of Fractions 83
2.5 Converting Decimals to Fractions and Fractions to Decimals 91
Chapter 2 Quick Review 95
Chapter Terms 95
Case Study: Operating Expenses at Woodline Moldings and Trim 97
Case in Point Summary Exercise: Home Depot 98
Chapter 2 Test 99

Chapter 3
Percents 101

3.1 Writing Decimals and Fractions as Percents 102
3.2 Finding Part 109
3.3 Finding Base 116
Supplementary Application Exercises on Base and Part 120
3.4 Finding Rate 122
Supplementary Application Exercises on Base, Rate, and Part 126
3.5 Increase and Decrease Problems 130
Chapter 3 Quick Review 137
Chapter Terms 137
Case Study: Self Employed Retirement Plan 139
Case in Point Summary Exercise: Century 21 140
Chapter 3 Test 141

Chapter 4
Equations and Formulas 143

4.1 Solving Equations 144
4.2 Applications of Equations 152
4.3 Business Formulas 161
4.4 Ratio and Proportion 170
Chapter 4 Quick Review 179
Chapter Terms 179
Case Study: Forecasting Sales at Alcorn's Boutique 181
Case in Point Summary Exercise: General Motors 182
Chapter 4 Test 184
Chapters 1–4 Cumulative Review 188

Chapter 5
Bank Services 193

5.1 Electronic Banking, Checking Accounts, and Check Registers 194
5.2 Checking Services and Credit-Card Transactions 204
5.3 Bank Statement Reconciliation 209
Chapter 5 Quick Review 218
Chapter Terms 218
Case Study: Banking Activities of a Retailer 220
Case in Point Summary Exercise: Jackson & Perkins 221
Chapter 5 Test 223

Chapter 6
Payroll 225

6.1 Gross Earnings: Wages and Salaries 226
6.2 Gross Earnings: Piecework and Commissions 236
6.3 Social Security, Medicare, and Other Taxes 244
6.4 Income Tax Withholding 250
Chapter 6 Quick Review 262
Chapter Terms 262
Case Study: Payroll: Finding Your Take-Home Pay 265
Case in Point Summary Exercise: Payroll at Starbucks 266
Chapter 6 Test 267

Chapter 7
Mathematics of Buying 269

7.1 Invoices and Trade Discounts 270
7.2 Series Discounts and Single Discount Equivalents 280
7.3 Cash Discounts: Ordinary Dating Methods 284
7.4 Cash Discounts: Other Dating Methods 290
Chapter 7 Quick Review 297
Chapter Terms 297
Case Study: George Foreman 299
Case in Point Summary Exercise: Discounts at Bed Bath & Beyond 300
Chapter 7 Test 301

Chapter 8
Mathematics of Selling 303

8.1 Markup on Cost 304
8.2 Markup on Selling Price 311
Supplementary Application Exercises on Markup 319
8.3 Markdown 321
8.4 Turnover and Valuation of Inventory 327
Chapter 8 Quick Review 336
Chapter Terms 336
Case Study: Markdown: Reducing Prices to Move Merchandise 340
Case in Point Summary Exercise: Recreational Equipment Inc. (REI) 341
Chapter 8 Test 342
Chapters 5–8 Cumulative Review 344

Chapter 9
Simple Interest 347

9.1 Basics of Simple Interest 348
9.2 Finding Principal, Rate, and Time 359
9.3 Simple Discount Notes 367
9.4 Discounting a Note Before Maturity 376
Supplementary Application Exercises on Simple Interest and Simple Discount 384
Chapter 9 Quick Review 388
Chapter Terms 388
Case Study: Banking in a Global World: How Do Large Banks Make Money? 392
Case in Point Summary Exercise: Apple, Inc. 393
Chapter 9 Test 394

Chapter 10
Compound Interest and Inflation 397

10.1 Compound Interest 398
10.2 Interest-Bearing Bank Accounts and Inflation 409
10.3 Present Value and Future Value 419
Chapter 10 Quick Review 425
Chapter Terms 425
Case Study: Valuing a Chain of McDonald's Restaurants 427
Case in Point Summary Exercise: Bank of America 428
Chapter 10 Test 429
Chapters 9–10 Cumulative Review 431

Chapter 11
Annuities, Stocks, and Bonds 433

11.1 Annuities and Retirement Accounts 434
11.2 Present Value of an Ordinary Annuity 442
11.3 Sinking Funds (Finding Annuity Payments) 450
Supplementary Application Exercises on Annuities and Sinking Funds 458
11.4 Stocks and Mutual Funds 460
11.5 Bonds 469
Chapter 11 Quick Review 476
Chapter Terms 476
Case Study: Financial Planning 479
Case in Point Summary Exercise: American River College 480
Chapter 11 Test 481

Chapter 12
Business and Consumer Loans 483

12.1 Open-End Credit and Charge Cards 484
12.2 Installment Loans 495
12.3 Early Payoffs of Loans 503
12.4 Personal Property Loans 510
12.5 Real Estate Loans 518
Chapter 12 Quick Review 526
Chapter Terms 526
Case Study: Consolidating Loans 530
Case in Point Summary Exercise: Underwater on a Home 532
Chapter 12 Test 534
Chapters 11–12 Cumulative Review 536

Chapter 13
Taxes and Insurance 539

13.1 Property Tax 540
13.2 Personal Income Tax 547
13.3 Fire Insurance 561
13.4 Motor-Vehicle Insurance 571
13.5 Life Insurance 579
Chapter 13 Quick Review 585
Chapter Terms 585
Case Study: Financial Planning For Property Taxes and Insurance 588
Case in Point Summary Exercise: Mattel Inc.—Taxes and Insurance 589
Chapter 13 Test 591

Chapter 14
Depreciation 593

14.1 Straight-Line Method 594
14.2 Declining-Balance Method 602
14.3 Sum-of-the-Year's-Digits Method 609
Supplementary Application Exercises on Depreciation 616
14.4 Units-of-Production Method 620
14.5 Modified Accelerated Cost Recovery System 625
Chapter 14 Quick Review 633
Chapter Terms 633
Case Study: Comparing Depreciation Methods 635
Case in Point Summary Exercise: Ford Motor Company 636
Chapter 14 Test 637

Chapter 15
Financial Statements and Ratios 639

15.1 The Income Statement 640
15.2 Analyzing the Income Statement 645
15.3 The Balance Sheet 652
15.4 Analyzing the Balance Sheet 656
Chapter 15 Quick Review 664
Chapter Terms 664
Case Study: Bicycle Shop 667
Case in Point Summary Exercise: Apple, Inc. 669
Chapter 15 Test 671

Chapter 16
Business Statistics 673

16.1 Frequency Distributions and Graphs 674
16.2 Mean, Median, and Mode 685
Chapter 16 Quick Review 693
Chapter Terms 693
Case Study: Watching a Small Business Grow 695
Case in Point Summary Exercise: Bobby Flay 696
Chapter 16 Test 697

Appendix A
The Metric System A-1

Appendix B
Basic Calculators B-1

Appendix C
Financial Calculators C-1

Appendix D
Exponents and Order of Operations D-1

Appendix E
Graphing Equations E-1

Answers to Selected Exercises AN-1
Glossary G-1
Index I-1
Photo Credits P-1

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.

Our state-of-the-art supplements package includes an enhanced PowerPoint package, an extensive instructor's manual, and a wealth of online resources for instructors. 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 online resources. 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.

Instructor Supplements

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 and is available for download from the Instructor's Resource Center.

Online Instructor's Resource Manual (Download only) This manual 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. It is available for download from the Instructor's Resource Center.

MEDIA RESOURCES

TESTGEN®

TestGen® (www.pearsonglobaleditions.com/clendenen) 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.

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As an author team, we are committed to providing the best possible text to help instructors teach and students succeed. As we continue to work toward this goal, we would welcome any comments or suggestions you might have via e-mail to gclendenen@yahoo.com. Please use "Business Math" in the regarding line.

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Gary Clendenen received bachelor's and master's degrees in mathematics before going into business for himself in the oil industry. He returned to academia and earned his Ph.D. in Business Management in 1993 and has been a faculty member since then. His business experience includes working as an actuary for an insurance company and owning commercial real estate. He has published papers in numerous refereed journals and does volunteer work with several organizations. His hobbies include long bicycle rides, traveling, and reading on diverse topics such as the history of the Apache Indians of the Southwest, economics, and issues related to potential shortages of energy, water, and minerals. He has two sons and several grandchildren.

Stanley A. Salzman has taught Business Math, Marketing, and Real Estate courses at American River College in Sacramento for 35 years. He says, "Some of my greatest moments in teaching have been seeing the look on the face of a student who understands a business math concept or idea for the first time." Stan and his wife have four children and eight grandchildren. Stan likes outdoor activities, exercising, and collecting antique toy trains.

Charles D. Miller (deceased) was instrumental in writing the early editions of this book as well as several other books. We continue to find inspiration and guidance in his passion for excellence.

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: $\begin{array}{r} 7801 \\ \times\ 1758 \\ \hline \end{array}$

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

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

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

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

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: $\begin{array}{r} 598.316 \\ -\ 79.839 \\ \hline \end{array}$

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

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.

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25. _____
26. _____
27. _____
28. _____
29. _____
30. _____

Index of Applications

A

Agriculture
- Alligator hunting, 454
- Christmas tree farm, 373
- Commercial fertilizer, 89
- Commercial fishing boats, 607, 632
- Egg production, 34
- Farmland prices, 135
- Forestry operations, 515
- Gardening, 75
- Land area, 39
- Land sale, 455
- Landscaping, 507
- Long-stemmed roses, 320
- Pecan trees, 502
- Race horses, 374
- Trucks & sprayers, 373

Automotive/Transportation
- Antilock brakes, 134
- Automotive, 296
- Auto parts startup, 168
- Auto production, 177
- Auto repair, 75, 160
- Auto sales, 135
- Big rims and tires, 54
- Camaros and Mustangs, 120
- Company vehicles, 630
- Diesel tractor, 618
- Driving distractions, 113
- Driving tests, 119
- Fire truck, 456
- Fuel consumption, 90
- Garbage truck, 509
- Harley Davidson, 160
- Heavy-duty truck, 624
- Hybrid Toyota, 54
- International airline, 662
- Map reading, 176
- Motorcycles, 546
- Motorcycle safety, 126
- Mustang, 167
- Petroleum transport, 76
- Police cruisers, 288
- Shuttle van, 617
- Ski boat, 501
- SUV sales, 39
- Tractor parts, 310
- Tractor purchase, 382, 501, 515
- Trailer load, 81
- Transmission, 76
- Transmission repair, 662
- Truck accessories, 326
- Vehicle depreciation, 600
- Weighing freight, 39
- Wheels with bling, 295
- Yard Maintenance, 40

B

Banking
- Accumulating $1,000,000, 454
- Amortizing a loan, 516
- Amount due, 296
- Amount owed the IRS, 260
- Bad credit history, 374
- Bank balances, 202
- Bank loan, 364
- Benefit increase, 128
- Budgeting, 128
- Capital improvement, 357
- Checking account records, 48
- Check processing, 39
- Commission with returns, 243
- Completing check stubs, 201
- Compounding, 416
- Corporate finance, 357, 407
- Corporate savings, 417
- Credit card balance, 492
- Credit-card deposits, 207, 208
- Credit union, 406
- Current checking balance, 213
- Emergency cash, 417
- Financing college expenses, 423
- Financing construction, 382
- Finding interest, 168
- Finding time, 168
- Home loan, 525
- Inflation and retirement, 417
- Inheritance, 169, 417
- Interest earnings, 365
- Interest rate, 365
- International finance, 374, 406, 407
- Loan amount, 169
- Loan collateral, 416
- Loan qualification, 119
- Loans between banks, 357
- Loan to an uncle, 168
- Maturity value, 168
- Maximizing interest, 407
- Minority loans, 136
- Partial invoice payment, 296
- Partial payment, 507
- Payment due, 296
- Penalty on late payment, 365
- Poor credit, 373
- Promissory note, 365
- Putting up collateral, 417
- Reconciling checking accounts, 214, 215
- Retirement account, 120, 365
- Retirement funds, 474
- Retirement income, 417
- Retirement planning, 441
- Salary plus commission, 243
- Saving for a home, 441
- Saving for retirement, 364
- Savings, 168, 406
- Savings account, 416
- Short-term savings, 364
- Student loan, 168
- Time of deposit, 365, 366, 416
- Time or rate?, 407
- United Kingdom, 406
- Variable-commission payment, 243
- Writing a will, 468

Business
- Abbreviations on invoices, 276–277
- Advertising expenses, 124, 125
- Automotive supplies, 319
- Barge depreciation, 601
- Battery store, 382
- Best Buy, 235
- Book publishing, 683
- Bridal shop, 167
- Business expansion, 423
- Business fixtures, 600
- Business ownership, 115
- Business safe, 617
- Cadillac dealer, 661
- Calculation gross earnings, 53–54
- Call center, 40
- Catering company, 288
- Chiquita Brands International, 136
- Clothing store, 166
- Coffee shop, 649
- Commercial carpeting, 89
- Comparing discounts, 283
- Corporate profits, 112
- Cost after markdown, 126
- As of dating, 289
- Dealer's cost, 134
- Dental-supply company, 644
- Discount dates, 296
- Entrepreneur, E-12
- Evaluating inventory, 335
- Expanding manufacturing operations, 423
- Finding discount dates, 289
- Flower shop, 649
- Food inflation, 134
- Gift shop, 643
- Grocery chain, 654
- Grocery store, 449
- Guitar shop, 649
- Hotel room costs, 39
- Ice cream shop, 643
- Independent bookstore ownership, 632
- International business, 357
- International shipments, 159
- Inventory, 356, 508
- Inventory purchase, 366
- Juice company, 661
- Luxury hotels, 40
- Managerial earnings, 54
- New product failure, 114
- New showroom, 455
- Offshore drilling, 631
- Oil profits, 176
- Opening a restaurant, 515
- Paint store, 358, 613
- Paper products manufacturing, 135
- Partial invoice payment, 295
- Partnership profits, 176
- Print shop, 416
- Product purchases, 30
- Quality, E-11
- Retail giants, 34
- Russian electrical supplies, 288
- Sewing center, 382
- Ship building, 159
- Shopping center, 632
- Simple discount rate, 374
- Soft-drink bottling, 619
- Spray-paint inventory, 334
- Stock turnover at cost, 334
- Stock turnover at retail, 334
- Stock value, 136
- Using invoices, 275–276
- Value of a business, 423, 424
- Walmart supercenter, 545
- Woman's clothing shop, 176
- Women in business, 32

Business equipment
- Business signage, 617
- Canning machine, 501
- Car-wash machinery, 618
- Ceiling fans, 319
- Commercial carpet, 615
- Commercial fishing boats, 607, 632

Commercial freezer, 614
Communication equipment, 320
Company vehicles, 630
Deep fryer, 624
Dental office furniture, 632
Depreciating computer equipment, 601
Depreciating machinery, 601
Depreciating office furniture, 613
Double-pane windows, 319
Drilling rig, 601
Electronic equipment, 516
English soccer equipment, 295
Forklift depreciation, 614
George Foreman grill, 289
Hospital equipment, 615
Industrial forklift, 618
Jewelry display cases, 617
Kitchen equipment, 40, 294
Laboratory equipment, 600
Machinery depreciation, 599
Oak desk, 325
Printer, 515
Refrigerated display case, 619
Scuba equipment, 517
Storage tank, 630
Surplus-equipment auction, 135
Woodworking machinery, 616
X-ray equipment, 455

C

Construction
Airplane hangar, 568
Apartment owner, 545
Asphalt crumb, 509
Cabinet installation, 75, 76
Commercial building, 159, 456, 568
Concrete footings, 90
Construction power tools, 608
Conveyor system, 607
Delivering concrete, 82
Elderly housing, 525
Excavating machinery, 608
Financing construction, 382
Finish carpentry, 88
Forklift depreciation, 614
Home construction, 366
Landscape equipment, 615, 616
New kitchen, 456
New roof, 373, 456
Office complex, 545, 632
Offshore drilling, 631
Parking lot fencing, 81
Perimeter of fencing, 77
Remodeling, 508
Road paving, 357
Rock crusher, 381
Security fencing, 81
Stainless steel grill, 283
Theater renovation, 40
Triplex, 569
Warehouse construction, 616
Weather stripping, 90
Window installation, 81
Yacht construction, 660

D

Domestic
Electricity rates, 88
Home beverage fountains, 278
Home-value appreciation, 134
Household lubricant, 120
Lights out, 126
Personal budgeting, 119
Producing crafts, 88
Tailored clothing, 82

E

Education
College bookstore, 206–207
College enrollment, 118, 136
College expenses, 135, 448
College textbooks, 39, 167
Exchange program, 159
High school dropouts, 127
Paying for college, 448
Private school equipment, 608
Saving for college, 456
Student union, 454
Textbooks, 310
University fees, 136
Vocabulary, 125
Employment/Employee benefits
Aiding disabled employees, 121
Computer consultant, 507
Earnings calculation, 88
Employee net pay, 259
Employee population base, 118
Female lawyers, 113
Guaranteed hourly work, 242
Heating-company representative, 261
Hiring, 119
Insurance office manager, 234
Job cuts, 124
Key employee insurance, 584
Layoff alternative, 127
Managerial earnings, 54
Marketing representative, 260
Nurses, 114
Nursing, 125
Office assistant, 234
Part-time work, 81
Payroll, 248, 249, 364
Piecework with overtime, 243
Retail employment, 234
Retirement, 441
River raft manager, 261
Self-employment, 249, 423
Starbucks district manager, 260
Store manager, 235
Video player, 277
Women in the military, 124
Women in the Navy, 113
Working in China, 178
Entertainment/Sports
Athletic shoes, 335
Athletic socks, 334–335
Bowling equipment, 320
Casino, 373
Competitive cyclist training, 39
Dance shoes, 278
Drums, 319
DVD rentals, 135
Eating out, 134
Elliptical trainer, 325
Exercycle, 309
Fishing boat, 39
Fly-fishing, 319
Gambling payback, 119
Gaming, 167
Golf cart, 319
Golf clubs, 310
Home-workout equipment, 318
Kayak, 325
Lost overboard, 126
Motorcyclists, 125
Mountain bike, 320
Movie projectors, 509
Movies, 167
Musical instruments, 166
New auditorium, 455
NINTENDO, 283
NY Yankees, 113
Parachute jumps, 32
Piano repair, 335
Recreation equipment, 617
Rock concert, 177
Scuba diving, 454
Scuba equipment, 517
Scuba shoppe, 649
Ski jackets, 309
Snowboard, 319
Sports complex, 456
Sportswear, 320
Sport T-shirts, 334
Sprint training, 76
Summer vacation, 92, E-13
Super Bowl advertising, 114
Swimming, 175
Swimming pool pump, 318
Table-tennis tables, 310
Tanning salon, 125
Theater seating, 617
Vacation mistakes, 126
Water skis, 159
Weight-training books, 310
Yachts, 661
Youth soccer, 40
Environment
Earthquake damage, 374
Effects of global warming, 126
Flooding, E-10
Global warming, 176
Hurricane Katrina, 32
Sea levels, 176
Water scarcity, 128
Winter-wheat planting, 135

F

Family
Alimony, 48
Child-care payments, 441
Child support, 120
Divorce settlement, 423
Family budget, 114
Family restaurant, 134
Family size, 119
Head of household, 560
Married, 560
Saving to buy a home, 128
Food service industry
Bakery, 423
Beef/turkey cost, 48
Biscuits, 175
Cake recipe, 76
Campus vending machines, 33
Canadian food products, 295
Chicken noodle soup, 128
Coffee shop, 649
Fast-food restaurants, 615
Frozen yogurt, 295
Goat cheese, 502
Health food, 357
Hershey Kisses, 33
Hershey mini chips, 33
Kitchen island, 278
McDonald's, E-10
Pizza, 167, 374
Restaurant tables, 619
Sales of health food, 176
Selling bananas, 318
Subway sandwiches, 38
Tiger food, 175
Wine, 319

G

General interest
Airport improvements, 455
Antiques, 169, 326

Apparel, 643
Bar soap, 113
Bed in a bag, 319
Beer consumption, 125
Blouses, 318
Bracelet, 283
Crystal from Ireland, 295
Custom-made jewelry, 310
Engagement ring, 508
Fires, 136
Furniture, 682
Iceberg volume, 177
Island area, 177
Japanese Yen, 177
Liquid fertilizer, 278
Making jewelry, 90, 382
Man's best friend, 119
Native-American jewelry, 77
Population forecasts, 127
Rare stamps, 455
Responder backpack, 309
Restaurant tips, 48
Sewer drain service, 615
Shampoo ingredients, 120
Social Security, 449
Songbird migration, 177

Government
American Chiropractic Association, 126
Biker helmet laws, 127
Criminal justice, 358
Disaster relief, 448
Gross national product, 32
Injury lawsuit, 448
Law enforcement, 364
Salvation Army, 32
Salvation army loss, 569
Total World War II veterans, 39
U.S. Paper money, 55
U.S. Patent recipients, 129
Voter registration, 119
War deaths, 683
World War II Veterans, 39

H

Healthcare
Bad medicine, 94
Blood-alcohol levels, 129
Blood cells, 175
Blood-cholesterol levels, 120
Calories from fat, 120
Cone zone deaths, 136
Criminology lab, 234
Dental office furniture, 632
Dispensing eye drops, 90
Flu pandemic of 1918, 120
Gambling with health, 94
Health food, 357
Health in a machine, 128
Hospital equipment, 615
Medicine dose, 55
Motor Vehicle Accidents, 32
Overweight, 113
Oxygen supply, 661
Physically impaired, 40
Sick pet, 121
Side-impact collisions, 128
Smoking and cancer, 94
Smoking and lung disease, 113
Smoking or nonsmoking, 119
Social Security and Medicare, 248, 249
Weight-training equipment, 606

I

Insurance
Adult auto insurance, 577
Bodily injury insurance, 577
Coinsured fire loss, 569
Fire insurance premium, 568
Fire loss, 568
Gift-shop fire loss, 569
Industrial building insurance, 568
Insurance company payment, 578
Key employee insurance, 584
Life insurance, 584
Major fire loss, 569
Medical expenses and property damage, 578
Multiple carriers, 569
Partial coverage, 569, 570
20-Pay life policy, 584
Premium factors, 584
Property insurance, 120
Universal life insurance, 584
Whole life insurance, 584
Youthful-operator auto insurance, 577
Youthful operator—no driver's training, 577

R

Real estate
Home ownership, 118
Home prices, 127
Real estate commissions, 114
Real estate development, 175
Real estate fees, 54
Residential rental property, 631

S

Sales/Marketing
Auto purchase, 501
Auto sales, 135
Auto sales in China, 114
Boat purchase, 373
Computer sales, E-13
Condominium purchase, 525
Consumer internet sales, 115
Crayon sales, 32
Deli sales, 134
Department sales, 30
Determining purchasing power, 417
Educational sales, 260
Firewood sale, 90
Hardware purchase, 278
Home purchase, 525
Hot tub purchase, 492
Inside sales, 234
iPad sales, 33
iPhone discount, 126
Jell-O sales, 32
Jetson aircraft sales, 655
Monthly sales, E-11
National home sales, 135
Nissan sales, 160
Nursing-care purchases, 277
Pottery-shop sales, 318
Purchase of T-bills, 374, 383
Real estate fees, 54
Recreation equipment rental, 33
Refrigerator purchase, 501
River-raft sales, 318
Sales of health food, 176
Selling a restaurant, 448
Selling bananas, 318
Soda sales, 159
Subway sales, 47
Telemarketing teamwork, 33
Ticket sales, 175
Total cost, 114
Total sales, 128
Tractor purchase, 382, 501, 515
Travel-agency sales, 260
Tripod purchase, 278
Van purchase, 448
Vegetable sales, 160
Wholesale auto parts, 278

Science/Technology
Apple, Inc., E-11
Canning machine, 501
Carpet-cleaning equipment, 607
Ceiling fans, 319
Cell phones, 373, E-12
Chip fabrication, 501
Communication equipment, 608
Computer chips, 167
Computer replacement, 448
Computer system, 501
Construction power tools, 608
Conveyor system, 607
Copy machines, 616
Device assembly, 75
Digital camera, 114
Digital thermometers, 319
Electric guitar, 500
Electronic analyzer, 607
Facebook users, 135
Fiber optics, 279
Flash drive, 320
Global Positioning Systems (GPS), 283, 295, 325
Graphic arts, 278
iPad, 283
Laptops, 365, 632
Lawn-mower, 345, E-13
Measuring brass trim, 81
Metal lathe, 500
Notebook, 39
Outdoor lighting, 310
Personal organizers, 616
Playset, 500
Printing, 509
Refrigerators, 166
Smart phones, 496, E-14
Sound system, 159
Studio sound system, 606
Surveillance cameras, 508
Video equipment, 618
Web design, 357, 373, 509
Wind energy, 125
Wind turbine, 614

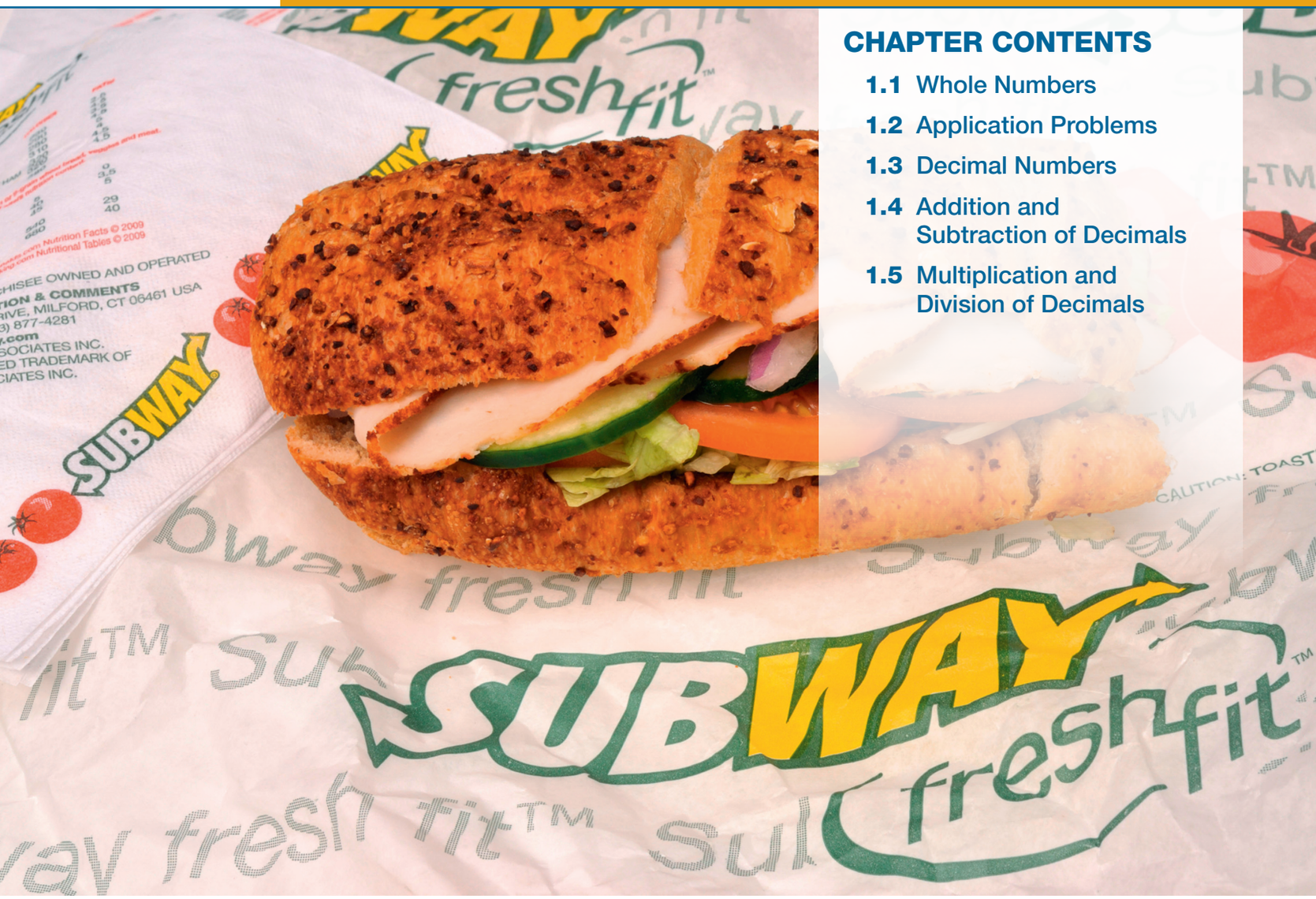
Stocks/Investments
Bond fund, 474, 475
Bond purchase, 474
CDS or global stocks, 468
Fixed rate or stocks, 468
Investing in bonds, 364
Investment, 406, 407
Investment decision, 406
Mutual fund investing, 441
Stock price, E-12
Stock purchase, 468
T-bill and stock investing, 441
Trade-discount comparison, 278

T

Taxes
Commercial property tax, 545
Comparing property tax rates, 546
Federal withholding tax, 258
Gasoline taxes, 113
Income tax payment, 373
Married—income tax, 559, 560
Penalty on unpaid income tax, 358
Penalty on unpaid property tax, 357
Real estate taxes, 545
Sales tax, 113, 134
Sales-tax computation, 114
Single—income tax, 559
State withholding tax, 258
Taxes on home, 546
Top tax rates, 684

Business Mathematics

1 Whole Numbers and Decimals



CHAPTER CONTENTS

1.1 Whole Numbers

1.2 Application Problems

1.3 Decimal Numbers

1.4 Addition and Subtraction of Decimals

1.5 Multiplication and Division of 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.

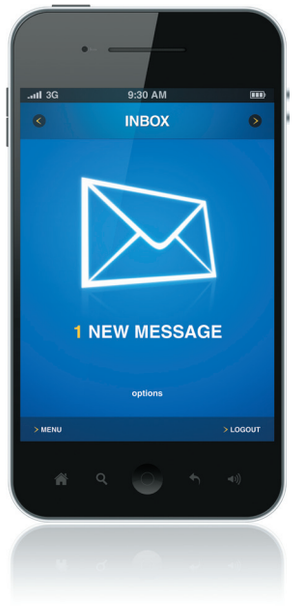
This text will improve your ability to work with numbers which is important! It also teaches you important concepts that relate to your personal life (debt, savings, investment, home mortgages, insurance, and taxes) and the workplace (markup, markdown, bank services, payroll, and simple interest). You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

1.1 Whole Numbers

OBJECTIVES

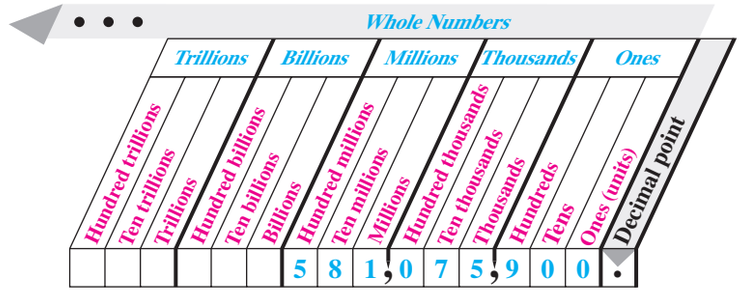
1. Define whole numbers.
2. Round whole numbers.
3. Add whole numbers.
4. Round numbers to estimate an answer.
5. Subtract whole numbers.
6. Multiply whole numbers.
7. Multiply by omitting zeros.
8. Divide whole numbers.

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.

$$5\underline{7}9$$

Round to this place.

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.

579 rounded to the nearest ten is 580.

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.

(b) Step 1 Locate the thousands place and underline. 3$\underline{4}$,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.

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

(c) Step 1 Locate the ten thousands place and underline. 4$\underline{7}$5,871

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. 7$\underline{9}$,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 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**.

$$\begin{array}{r} 8 \\ +\ 9 \\ \hline 17 \end{array}$$

8 addend

+ 9 addend

17 sum (answer)

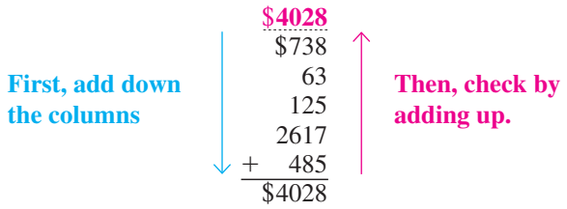
Add numbers by arranging them in a column with units above units, tens above tens, hundreds above hundreds, thousands above thousands, and so on. Use the decimal point as a reference for arranging the numbers. If a number does not include a decimal point, the decimal point is assumed to be at the far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

Quick TIP

Always be sure to check your work.



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.

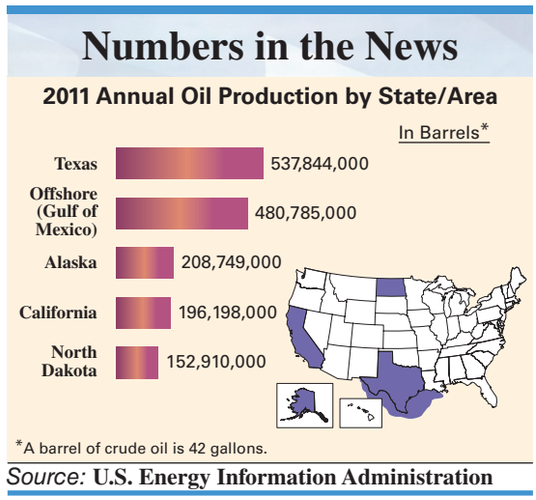
QUICK CHECK 3

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.



Quick TIP

In front-end rounding, only one nonzero digit (first digit) remains. All digits to the right are zeros.

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.

QUICK CHECK 4

Use front-end rounding to estimate the total of the following numbers.

621,150; 38,400; 9682; 27,451; 435,620

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**.

$$\begin{array}{rl} 23 & \text{minuend} \\ -\ 7 & \text{subtrahend} \\ \hline 16 & \text{difference} \end{array}$$

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.

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

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.

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

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

QUICK CHECK 5

Subtract 7832 customers from 9511 customers.

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

$$\begin{array}{rl} 5383 & \text{minuend} \\ -\ 1635 & \text{subtrahend} \\ \hline 3748 & \textbf{difference} \end{array}$$

Problem (subtract down)

Check

$$\begin{array}{rl} 5383 & \text{This result should equal the minuend.} \\ +\ 1635 & \\ \hline 3748 & \text{Check (add up)} \end{array}$$

QUICK CHECK 6

Subtract 2374 from 4165, and check the answer.

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

Quick TIP

It is okay to change the order when multiplying two numbers. For example, $8 \cdot 5 = 5 \cdot 8$.

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
$\times$ 34	$\times$ 34	$\times$ 34	$\times$ 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.

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

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

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

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,

$33 \times 10 = 33$ and 1 zero $= 330$
$56 \times 100 = 56$ and 2 zeros $= 5600$
$732 \times 1000 = 732$ and 3 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.

$$\underset{\text{dividend}}{15} \div \underset{\text{divisor}}{5} = \underset{\text{quotient}}{3} \qquad \underset{\text{divisor}}{5}\overline{)\underset{\text{dividend}}{15}} \quad \text{quotient: } 3$$

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

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.

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

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.

$$\begin{array}{r} 73 \\ \times\ 15 \\ \hline 365 \\ \underline{73} \\ 1095 \end{array}$$

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
$5\text{ R}6$	$5\frac{6}{24}$	5.25
$24\overline{)126}$	$24\overline{)126}$	$24\overline{)126.00}$
120	120	120
6	6	60
		48
		120
		120
		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.

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

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.

Quick TIP

After dropping zeros and dividing, do not add trailing zeros back to the answer.

Therefore, $108{,}000 \div 900 = 120$.

QUICK CHECK 11

First drop zeros, and then divide $19{,}200 \div 300$.

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)

$$716\overline{)26{,}495}\quad\begin{array}{r}37\text{ R}3\\ 21\,48\\ \hline 5\,015\\ 5\,012\\ \hline 3\end{array}$$

remainder

(b)

$$418\overline{)35{,}536}\quad\begin{array}{r}85\text{ R}6\\ 33\,44\\ \hline 2\,096\\ 2\,090\\ \hline 6\end{array}$$

remainder

Quick TIP

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

SOLUTION

(a)

$$\begin{array}{r} 716 \\ \times\ 37 \\ \hline 5012 \\ 2148 \\ \hline 26{,}492 \\ +\ \ 3 \\ \hline 26{,}495 \end{array}$$

add remainder

correct

(b)

$$\begin{array}{r} 418 \\ \times\ 85 \\ \hline 2090 \\ 3344 \\ \hline 35{,}530 \\ +\ \ 6 \\ \hline 35{,}536 \end{array}$$

add remainder

correct

QUICK CHECK 12

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

1.1 Exercises

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.)

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

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

15.
$$\begin{array}{r} 75 \\ 63 \\ 45 \\ +\ 27 \\ \hline 210 \end{array}$$

16.
$$\begin{array}{r} 57 \\ 26 \\ 43 \\ +\ 18 \\ \hline \end{array}$$

17.
$$\begin{array}{r} 875 \\ 364 \\ 171 \\ +\ 776 \\ \hline \end{array}$$

18.
$$\begin{array}{r} 135 \\ 594 \\ 415 \\ +\ 276 \\ \hline \end{array}$$

19.
$$\begin{array}{r} 750 \\ 91 \\ 8 \\ 540 \\ +\ 7 \\ \hline \end{array}$$

20.
$$\begin{array}{r} 371 \\ 45 \\ 839 \\ 3 \\ +\ 47 \\ \hline \end{array}$$

21.
$$\begin{array}{r} 311{,}479 \\ 77{,}631 \\ +\ 594{,}383 \\ \hline \end{array}$$

22.
$$\begin{array}{r} 803{,}526 \\ 759{,}991 \\ +\ 36{,}024 \\ \hline \end{array}$$

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

23.
$$\begin{array}{r} 896 \\ -\ 228 \\ \hline \end{array}$$

24.
$$\begin{array}{r} 757 \\ -\ 286 \\ \hline \end{array}$$

25.
$$\begin{array}{r} 3715 \\ -\ 838 \\ \hline \end{array}$$

26.
$$\begin{array}{r} 6215 \\ -\ 767 \\ \hline \end{array}$$

27.
$$\begin{array}{r} 65{,}198 \\ -\ 43{,}652 \\ \hline \end{array}$$

28.
$$\begin{array}{r} 445{,}193 \\ -\ 62{,}785 \\ \hline \end{array}$$

29.
$$\begin{array}{r} 7{,}025{,}389 \\ -\ 936{,}490 \\ \hline \end{array}$$

30.
$$\begin{array}{r} 9{,}807{,}943 \\ -\ 959{,}489 \\ \hline \end{array}$$

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							