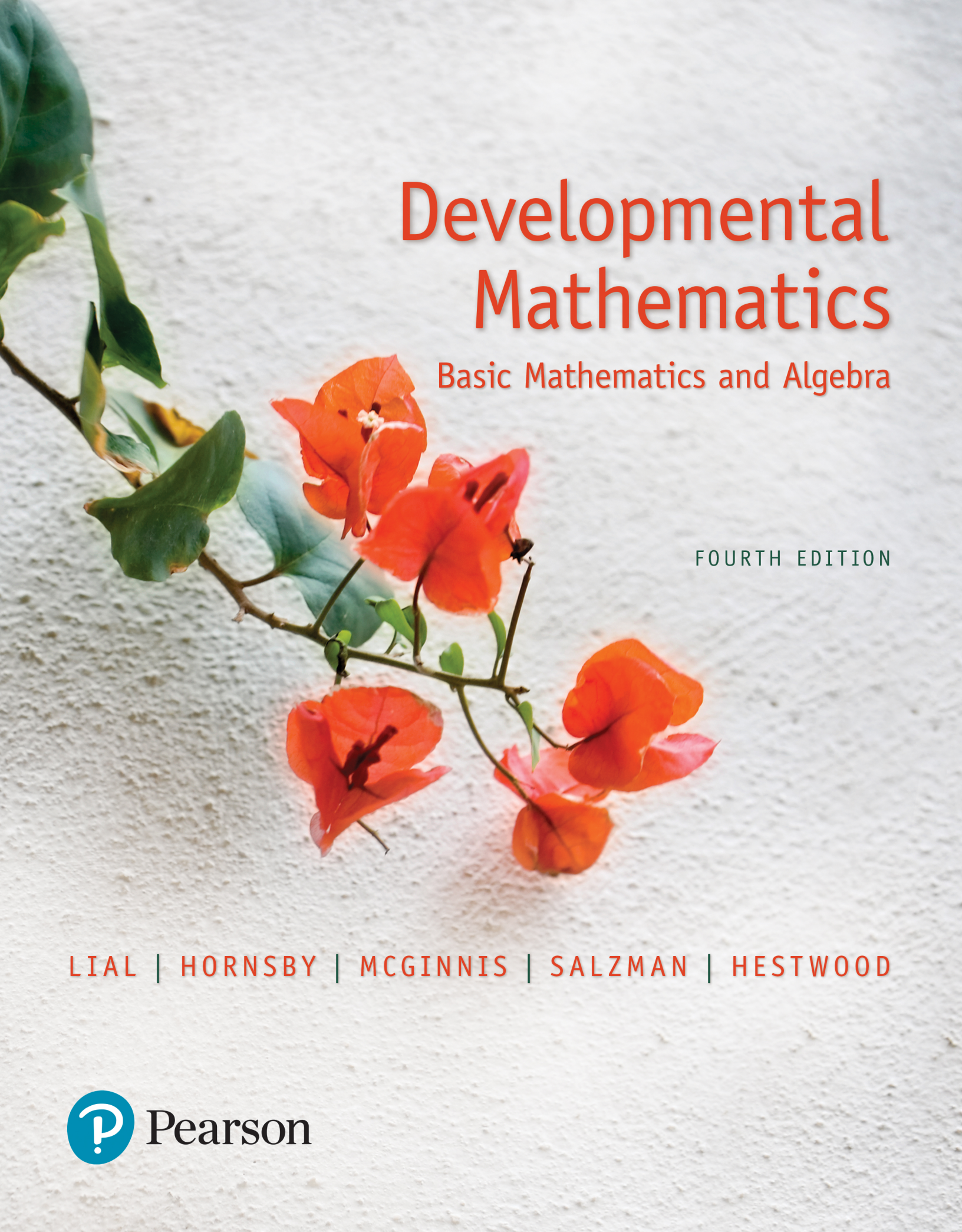

Developmental Mathematics

Basic Mathematics and Algebra

FOURTH EDITION

LIAL | HORNSBY | MCGINNIS | SALZMAN | HESTWOOD

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Fourth Edition

Developmental Mathematics

Basic Mathematics and Algebra

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Fourth Edition

Developmental Mathematics

Basic Mathematics and Algebra

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This book is dedicated to Margaret L. Lial

Always passionate about mathematics and teaching,

Always a valued colleague, a mentor, and a friend,

Always in our memory.

John Hornsby
Terry McGinnis
Stan Salzman
Diana Hestwood

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Preface

In the fourth edition of *Developmental Mathematics: Basic Mathematics and Algebra*, we have addressed the diverse needs of today's students by creating a tightly coordinated text and technology package that includes integrated activities to help students improve their study skills, an attractive design, updated applications and graphs, helpful features, and careful explanations of concepts. We have also expanded the supplements and study aids. We have revamped the video series into a complete Lial Video Library with expanded video coverage and new, easier navigation. We have also responded to the suggestions of users and reviewers and have added many new examples and exercises based on their feedback.

The text is designed for students who need to review basic mathematics and learn introductory algebra topics before moving on to an intermediate algebra course. This book begins with basic mathematics concepts, and then introduces geometry, statistics, and introductory algebra topics. Students will benefit from the text's student-oriented approach. Of particular interest to students and instructors will be the Guided Solutions in margin problems and exercises and the Concept Check exercises.

This text is part of a series that also includes the following books:

- *Basic College Mathematics,* Tenth Edition, by Lial, Salzman, and Hestwood
- *Prealgebra,* Sixth Edition, by Lial and Hestwood
- *Introductory Algebra,* Eleventh Edition, by Lial, Hornsby, and McGinnis
- *Intermediate Algebra,* Eleventh Edition, by Lial, Hornsby, and McGinnis
- *Introductory and Intermediate Algebra,* Sixth Edition, by Lial, Hornsby, and McGinnis

WHAT'S NEW IN THIS EDITION

We are pleased to offer the following new textbook features and supplements.

- ***Examples and Exercises*** Throughout the text, examples and exercises have been adjusted or replaced to reflect current data and practices. Applications have been updated and cover a wider variety of topics, such as the fields of technology, ecology, and health sciences.
- ***Relating Concepts Exercises*** Conceptual exercise sets have been expanded to help students tie concepts together and develop higher-level problem-solving skills as they compare and contrast ideas, identify and describe patterns, and extend concepts to new situations. These exercises make great collaborative activities for pairs or small groups of students. Additionally, each of these exercise sets is now covered and assignable in MyMathLab and tagged for easy location and assignment.
- ***Dedicated Mixed Review Exercises*** Each chapter review has been expanded to include more Mixed Review Exercises to help students further synthesize concepts.
- ***Improved Study Skills*** Many of these special activities now include a ***Now Try This*** section to increase student involvement. Each is designed independently to allow flexible use with individuals or small groups of students, or as a source of material for in-class discussions.
- ***Learning Catalytics*** Learning Catalytics is an interactive student response tool that uses students' own mobile devices to engage them in the learning process. Learning Catalytics is accessible through MyMathLab and is designed to be customized to each instructor's specific needs. Instructors can use Learning Catalytics to generate class discussion and promote peer-to-peer learning, and they can employ the real-time data generated to adjust

their instructional strategy. As an introduction to this exciting new tool, we have provided questions drawing on prerequisite skills at the start of each section to check students' preparedness for the new material. Learn more about Learning Catalytics in the Instructor Resources tab in MyMathLab.

- ***What Went Wrong*** Earlier editions of the text included exercises designed to help students find and fix errors, but in this edition these exercises have been updated and expanded with explicit instructions to emphasize the importance of this aspect of the learning process. When students can find and correct errors, they are demonstrating a higher level of understanding and conceptual knowledge.
- ***Concept Teaching Tips*** These tips point out the underlying mathematical concepts presented to students through the worked examples and margin problems. They highlight the importance of covering certain topics and suggest ways to help students deepen their understanding of key concepts. The Concept Teaching Tips are printed in the margins of the Annotated Instructor's Edition but are enclosed in a box to set them apart from regular Teaching Tips.
- ***Enhanced MyMathLab Features*** and ***Lial Video Workbook*** Videos have been updated and expanded throughout the course, including many new worked-through Solution Clips for exercises in every section. The corresponding workbook guides students through the videos for conceptual reinforcement - providing extra practice and Guided Examples linked to the videos.
- ***Data Analytics*** We analyzed aggregated student usage and performance data from MyMathLab for the previous edition of this text. The results of this analysis helped us improve the quality and quantity of exercises that matter the most to instructors and students.

HALLMARK FEATURES

We believe students and instructors will welcome these familiar hallmark features.

- ***Chapter Openers*** The new and engaging Chapter Openers portray real-life situations that make math relevant for students.
- ***Figures and Photos*** Today's students are more visually oriented than ever. Thus, we have made a concerted effort to include mathematical figures, diagrams, tables, and graphs whenever possible. Many of the graphs appear in a style similar to that seen by students in today's print and electronic media. Photos have been incorporated to enhance applications in examples and exercises.
- ***Emphasis on Problem Solving*** Introduced at the end of Chapter 1 and reinforced in Chapter 10, our six-step process for solving application problems is integrated throughout the text. We also provide students with **Problem-Solving Hint** boxes that feature helpful problem-solving tips and strategies.
- ***Learning Objectives*** Each section begins with clearly stated, numbered objectives, and the material within sections is keyed to these objectives so that students know exactly what concepts are covered.
- ***Guided Solutions*** Selected exercises in the margins and in the exercise sets, marked with a GS icon, show the first few solution steps. Many of these exercises can be found in the MyMathLab homework, providing guidance to students as they start learning a new concept or procedure.
- ***Pointers*** More pointers have been added to examples to provide students with important on-the-spot reminders and warnings about common pitfalls.

- ***Cautions and Notes*** One of the most popular features of previous editions, we include information marked CAUTION and Note to warn students about common errors and emphasize important ideas throughout the exposition. The updated text design makes them easy to spot.
- ***Calculator Tips*** These optional tips, marked with a red calculator icon, offer helpful information and instruction for students using calculators in the course.
- ***Margin Problems*** Margin problems, with answers immediately available at the bottom of the page, are found in every section of the text. This key feature allows students to immediately practice the material covered in the examples in preparation for the exercise sets.
- ***Ample and Varied Exercise Sets*** The text contains a wealth of exercises to provide students with opportunities to practice, apply, connect, and extend the skills they are learning. Numerous illustrations, tables, graphs, and photos help students visualize the problems they are solving. Problem types include skill building, writing, estimation, and calculator exercises, as well as applications and correct-the-error problems. In the Annotated Instructor's Edition of the text, the writing exercises are marked with an icon so that instructors may assign these problems at their discretion. Exercises suitable for calculator work are marked in both the student and instructor editions with a calculator icon. Students can watch an instructor work through the complete solution for all exercises marked with a Play Button icon in MyMathLab.
- ***Teaching Tips*** Although the mathematical content in this text is familiar to instructors, they may not all have experience in teaching the material to adult students. The Teaching Tips provide helpful comments from colleagues with successful experience at this level and offer cautions about common trouble spots. The Teaching Tips are printed in the margins of the Annotated Instructor's Edition.
- ***Solutions*** Solutions to selected section exercises are included in MyMathLab. This provides students with easily accessible step-by-step help in solving the exercises that are most commonly missed. Solutions are provided for the exercises marked with a square of blue color around the exercise number, for example, **15.**
- ***Summary Exercises*** All chapters now include this helpful mid-chapter review. These exercises provide students with the all-important *mixed* practice they need at these critical points in their skill development.
- ***Ample Opportunity for Review*** Each chapter ends with a Chapter Summary featuring Key Terms with definitions and helpful graphics, New Formulas, New Symbols, Test Your Word Power, and a Quick Review of each section's content with additional examples. Also included is a comprehensive set of Chapter Review Exercises keyed to individual sections, a set of Mixed Review Exercises, and a Chapter Test. Students can watch an instructor work out the full solutions to the Chapter Test problems in the Chapter Test Prep Videos.
- ***Test Your Word Power*** This feature, incorporated into each Chapter Summary, helps students understand and master mathematical vocabulary. Key terms from the chapter are presented, along with three possible definitions in a multiple-choice format. Answers and examples illustrating each term are provided.
- ***Written with developmental readers in mind.*** A significant proportion of developmental math students are also developmental reading students. With this in mind, we are thrilled to be working with a developmental reading instructor on this text, making sure that the material is as accessible as possible to our developmental students. This not only helps those students with weak reading skills, but helps *all* students by ensuring that the mathematics is accurate, but not obscured by unnecessarily complex writing.

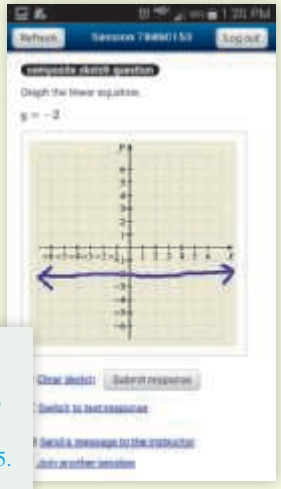
Resources for Success

MyMathLab Online Course for Lial/Hornsby/McGinnis/Salzman/Hestwood *Developmental Mathematics*, 4th edition

The corresponding MyMathLab course tightly integrates the authors' approach, giving students a learning environment that encourages conceptual understanding and engagement.

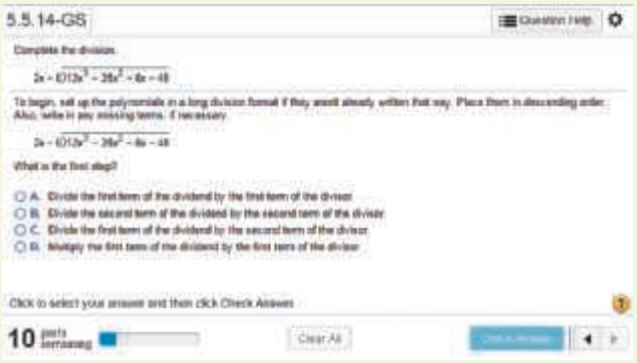
NEW! Learning Catalytics

Integrated into MyMathLab, Learning Catalytics use students' mobile devices for an engagement, assessment, and classroom intelligence system that gives instructors real-time feedback on student learning. LC annotations for instructors in the text provide corresponding questions that they can use to engage their classrooms.



LC LEARNING CATALYTICS

1. Which digit in the number 40,163 is in the ones place?
2. Identify the place value of 8 in the number 9875.



Expanded! Conceptual Exercises

In addition to MyMathLab's hallmark interactive exercises, the Lial team provides students with exercises that tie concepts together and help students problem-solve. Guided Solutions exercises, marked with a "GS" in the Assignment Manager, test student understanding of the problem-solving steps while guiding them through the solution process. Relating Concepts exercises in the text help students make connections and problem-solve at a higher level. These sets are assignable in MyMathLab, with expanded coverage.

NEW! Workspace Assignments

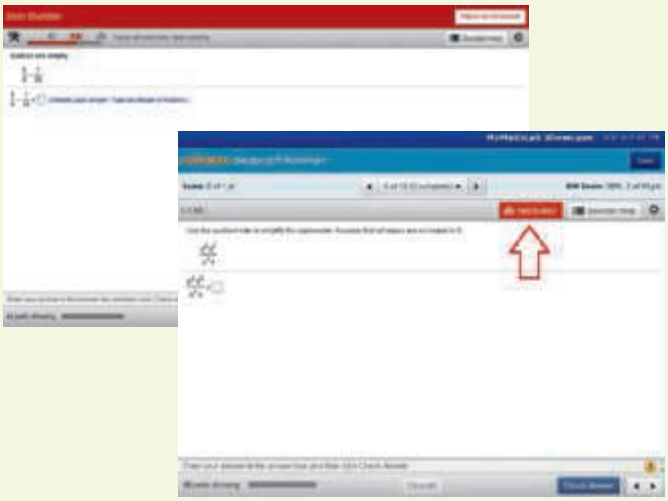
These new assignments allow students to naturally write out their work by hand, step-by-step, showing their mathematical reasoning as they receive instant feedback at each step. Each student's work is captured in the MyMathLab gradebook so instructors can easily pinpoint exactly where in the solution process students struggled.

www.mymathlab.com

Resources for Success

NEW! Adaptive Skill Builder

When students struggle on an exercise, Skill Builder assignments provide just-in-time, targeted support to help them build on the requisite skills needed to complete their assignment. As students progress, the Skill Builder assignments adapt to provide support exercises that are personalized to each student's activity and performance throughout the course.



Instructor Resources

Annotated Instructor's Edition

ISBN 10: 0-13-454192-8 **ISBN 13:** 978-0-13-454192-1
The AIE provides annotations for instructors, including answers, Learning Catalytics suggestions, and vocabulary and teaching tips.

The following resources can be downloaded from www.pearsonhighered.com or in MyMathLab:

Instructor's Solutions Manual

This manual provides solutions to all exercises in the text.

Instructor's Resource Manual

This manual includes Mini-Lectures to provide new instructors with objectives, key examples, and teaching tips for every section of the text.

PowerPoints

These slides, which can be edited, present key concepts and definitions from the text.

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.

Student Resources

Student Solutions Manual

ISBN 10: 0-13-454136-7 **ISBN 13:** 978-0-13-454136-5
This manual contains completely worked-out solutions for all the odd-numbered exercises in the text.

Lial Video Workbook

ISBN 10: 0-13-454135-9 **ISBN 13:** 978-0-13-454135-8
This workbook/note-taking guide helps students develop organized notes as they work along with the videos. The notebook includes

- Guided Examples to be used in conjunction with the Lial Section Lecture Videos and/or Objective-Level Video clips, plus corresponding Now Try This Exercises for each text objective.
- Extra practice exercises for every section of the text, with ample space for students to show their work.
- Learning objectives and key vocabulary terms for every text section, along with vocabulary practice problems.

ACKNOWLEDGMENTS

The comments, criticisms, and suggestions of users, nonusers, instructors, and students have positively shaped this textbook over the years, and we are most grateful for the many responses we have received. The feedback gathered for this revision of the text was particularly helpful, and we especially wish to thank the following individuals who provided invaluable suggestions for this and the previous edition:

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The ultimate measure of this textbook's success is whether it helps students master basic skills, develop problem-solving techniques, and increase their confidence in learning and using mathematics. In order for us, as authors, to know what to keep and what to improve for the next edition, we need to hear from you, the instructor, and you, the student. Please tell us what you like and where you need additional help by sending an e-mail to *math@pearson.com.* We appreciate your feedback!

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1

Whole Numbers

The Panama Canal, an American-built waterway, connects the Atlantic and Pacific Oceans. Completed over 100 years ago, the canal cut 8000 miles off the voyage between oceans by eliminating the need to sail around South America. The expansion of the 50-mile canal in 2016 required 32,000 workers. Now the canal can handle today's much larger cargo vessels that carry 14,000 containers (nearly three times the original number). In this chapter we discuss whole numbers, which are used daily in our lives.

Study Skills *Your Brain* **Can** *Learn Mathematics*

1.1 Reading and Writing Whole Numbers

Study Skills *Using Your Text*

1.2 Adding Whole Numbers

1.3 Subtracting Whole Numbers

1.4 Multiplying Whole Numbers

1.5 Dividing Whole Numbers

1.6 Long Division

1.7 Rounding Whole Numbers

1.8 Exponents, Roots, and Order of Operations

Study Skills *Taking Lecture Notes*

1.9 Reading Pictographs, Bar Graphs, and Line Graphs

1.10 Solving Application Problems

Study Skills

YOUR BRAIN *CAN* LEARN MATHEMATICS

OBJECTIVES

1. **Describe how practice fosters dendrite growth.**
2. **Explain the effect of anxiety on the brain.**

Your brain knows how to learn, just as your lungs know how to breathe; however, there are important things you can do to maximize your brain's ability to do its work. This short introduction will help you choose effective strategies for learning mathematics. This is a simplified explanation of a complex process.

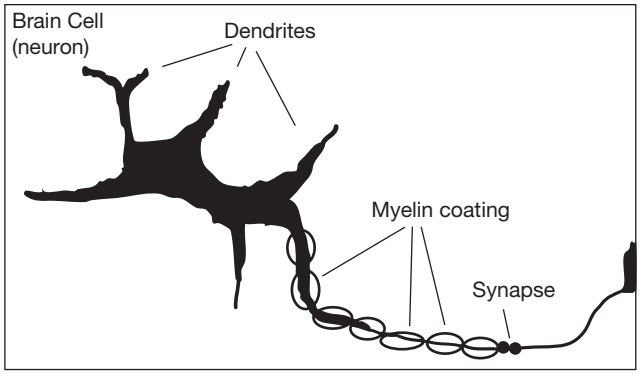
Your brain's outer layer is called the **neocortex,** which is where higher-level thinking, language, reasoning, and purposeful behavior occur. The neocortex has about 100 billion (100,000,000,000) brain cells called **neurons.**

Learning Something New

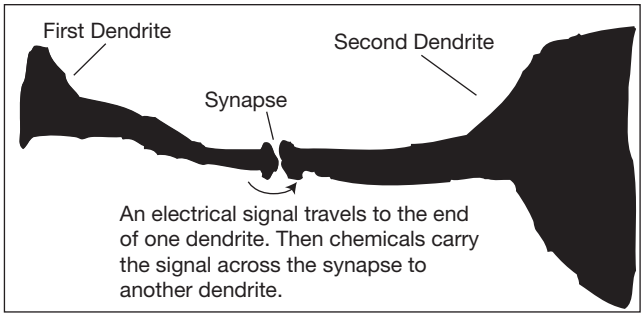
- As you learn something new, threadlike branches grow out of each neuron. These branches are called **dendrites.**
- When the dendrite from one neuron grows close enough to the dendrite from another neuron, a connection is made. There is a small gap at the connection point called a **synapse.** One dendrite sends an electrical signal across the gap to another dendrite.
- ***Learning = growth and connecting of dendrites.***

Remembering New Skills

- When you practice a skill just once or twice, the connections between neurons are very weak. If you do not practice the skill again, the dendrites at the connection points wither and die back. You have forgotten the new skill!



A neuron with several dendrites: one dendrite has developed a myelin coating through repeated practice.



A close-up view of the connection (synapse) between two dendrites.

- When you practice a new skill many times, the dendrites for that skill become coated with a fatty protein called **myelin.** Each time one dendrite sends a signal to another dendrite, the myelin coating becomes thicker and smoother, allowing the signals to move faster and with less interference. Thinking can now occur more quickly and easily, and ***you will remember the skill for a long time*** because the dendrite connections are very strong.

Become an Effective Student

- You grow dendrites specifically for the thing you are studying. If you practice dividing fractions, you will grow specialized dendrites just for dividing fractions. If you ***watch other people*** solve fraction problems, ***you will grow dendrites for watching, not for solving.*** So, be sure you are actively learning and practicing.
- If you practice something the ***wrong*** way, you will develop strong dendrite connections for doing it the wrong way! So, as you study, check frequently that you are getting correct answers.
- As you study a new topic that is related to things you already know, you will grow new dendrites, but your brain will also send signals throughout the network of dendrites for the related topics. In this way, you build a complex **neural network** that allows you to apply concepts, see differences and similarities between ideas, and understand relationships between concepts.

In the first few chapters of this text you will find "brain friendly" activities that are designed to help you grow and develop your own reliable neural networks for mathematics. Since you must grow your own dendrites (no one can grow them for you), these activities show you how to

- develop new dendrites,
- strengthen existing ones, and
- encourage the myelin coating to become thicker so signals are sent with less effort.

When you incorporate the activities into your regular study routine, you will discover that you understand better, remember longer, and forget less.

Also remember that ***it does take time for dendrites to grow.*** Trying to cram in several new concepts and skills at the last minute is not effective. Your dendrites simply can't grow that quickly. You can't expect to develop huge muscles by lifting weights for just one evening before a body-building competition! In the same way, practice the study techniques ***throughout the course*** to facilitate strong growth of dendrites.

When Anxiety Strikes

If you are under stress or feeling anxious, such as during a test, your body secretes **adrenaline** into your system. Adrenaline in the brain blocks connections between neurons. In other words, you can't think! If you've ever experienced "blanking out" on a test, you know what adrenaline does. You'll learn several solutions to that problem in later activities.

Start Your Course Right!

- Attend all class sessions (especially the first one).
- Gather the necessary supplies.
- Carefully read the syllabus for the course, and ask questions if you don't understand.

1.1 Reading and Writing Whole Numbers

OBJECTIVES

1. Identify whole numbers.
2. Identify the place value of a digit.
3. Write a number in words or digits.
4. Read a table.

Knowing how to read and write numbers is important in mathematics.

OBJECTIVE 1 Identify whole numbers. The **decimal system** of writing numbers uses the ten digits

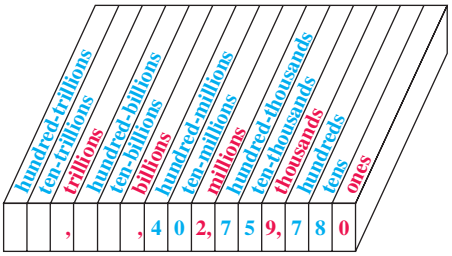
0, 1, 2, 3, 4, 5, 6, 7, 8, 9

to write any number. These digits can be used to write **the whole numbers:**

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 . . .

The three dots indicate that the list goes on forever.

OBJECTIVE 2 Identify Give the place value of a digit. Each digit in a whole number has a **place value,** depending on its position in the whole number. The following place value chart shows the names of the different places used most often and has the whole number 402,759,780 entered.



The United States is the leading consumer of coffee in the world. Each day we drink 402,759,780 cups of coffee. Each of the 7s in 402,759,780 represents a different amount because of its position, or *place value*, within the number. The *place value* of the 7 on the left is 7 hundred-thousands (700,000). The *place value* of the 7 on the right is 7 hundreds (700).

VOCABULARY TIP

Place value In our decimal number system, each place has a value of 10 times the place to its right.

EXAMPLE 1 Identifying Place Values

Identify the place value of 8 in each whole number.

Each "8" has a different value.

(a) 28 — 8 ones

(b) 85 — 8 tens

(c) 869 — 8 hundreds

Notice that the value of 8 in each number is different, depending on its location (place) in the number.

◀ Work Problem 1 at the Side.

EXAMPLE 2 Identifying Place Values

Identify the place value of each digit in the number 725,283.

7 2 5, 2 8 3

- 3 ones
- 8 tens
- 2 hundreds
- 5 thousands
- 2 ten-thousands
- 7 hundred-thousands

Continued on Next Page

1 Identify the place value of the 4 in each whole number.

GS **(a)** 342

3 4 2

- 2 ones
- 4 _____
- 3 hundreds

(b) 714

(c) 479

Answers

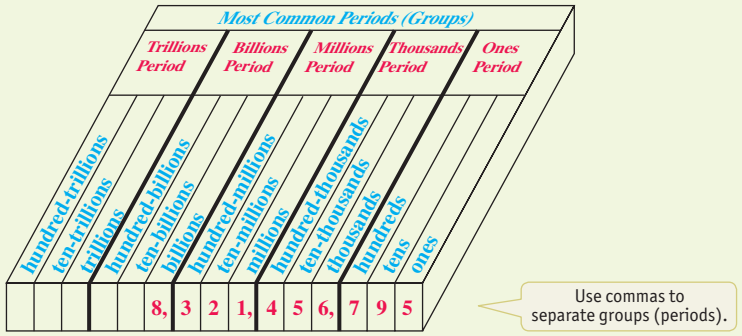
1. (a) tens **(b)** ones **(c)** hundreds

Notice the comma between the hundreds position and the thousands position in the number 725,283 in **Example 2.**

Work Problem 2 at the Side. ▶

Using Commas

Commas are used to separate each group of three digits, starting from the right. This makes numbers easier to read. (An exception: Commas are frequently omitted in four-digit numbers such as 9748 or 1329.) Each three-digit group is called a **period.** Some instructors prefer to just call them **groups.**



EXAMPLE 3 Knowing the Period or Group Names

Write the digits in each period of 8,321,456,795.

8,321,456,795

8 billions
321 millions
456 thousands
795 ones

Work Problem 3 at the Side. ▶

Use the following rule to read a number with more than three digits.

Writing Numbers in Words

Start at the left when writing a number in words or saying it aloud. Write or say the digit names in each period (group), followed by the name of the period, except for the period name "ones," which is *not* used.

OBJECTIVE 3 Write a number in words or digits. The following examples show how to write names for whole numbers.

EXAMPLE 4 Writing Numbers in Words

Write each number in words.

(a) 57

This number means 5 tens and 7 ones, or 50 ones and 7 ones. Write the number as

fifty-seven.

Continued on Next Page

2 Identify the place value of each digit.

GS **(a)** 14,218

8 ones
____ tens
____ hundreds
____ thousands
____ ten-thousands

(b) 460,329

3 In the number 3,251,609,328 identify the digits in each period (group).

(a) billions period

(b) millions period

(c) thousands period

(d) ones period

Answers

2. **(a)** 8 ones
1 tens
2 hundreds
4 thousands
1 ten-thousands
(b) 4 hundred-thousands
6 ten-thousands
0 thousands
3 hundreds
2 tens
9 ones

3. **(a)** 3 **(b)** 251 **(c)** 609 **(d)** 328

4 Write each number in words.

(a) 18

(b) 36

(c) 418

(d) 902

5 Write each number in words.

GS **(a)** 3104

three _____,

one _____ four

GS **(b)** 95,372

ninety-five _____,
three hundred seventy-two

(c) 100,075,002

(d) 11,022,040,000

6 Rewrite each number using digits.

(a) one thousand, four hundred thirty-seven

(b) nine hundred seventy-one thousand, six

(c) eighty-two million, three hundred twenty-five

Answers

4. **(a)** eighteen
(b) thirty-six
(c) four hundred eighteen
(d) nine hundred two

5. **(a)** three thousand, one hundred four
(b) ninety-five thousand, three hundred seventy-two
(c) one hundred million, seventy-five thousand, two
(d) eleven billion, twenty-two million, forty thousand

6. **(a)** 1437 **(b)** 971,006 **(c)** 82,000,325

(b) 94

ninety-four

Remember: Start at the *left* to read a number.

(c) 874

eight hundred seventy-four

(d) 601

six hundred one

◀ Work Problem 4 at the Side.

CAUTION

The word *and* should never be used when writing whole numbers. You will often hear someone say, "five hundred *and* twenty-two," but the use of "and" is not correct since "522" is a whole number. When you work with decimal numbers, the word *and* is used to show the position of the decimal point. For example, 98.6 is read as "ninety-eight *and* six tenths."

EXAMPLE 5 Writing Numbers in Words by Using Period Names

Write each number in words.

(a) 725,283

seven hundred twenty-five thousand, two hundred eighty-three

Number in period | Name of period | Number in period (not necessary to write "ones")

(b) 7252

Careful: *Do not* use "and" when reading a whole number.

seven thousand, two hundred fifty-two

Name of period | No period name needed

(c) 111,356,075

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

(d) 17,000,017,000

The period name is not used for the ones period.

seventeen billion, seventeen thousand

◀ Work Problem 5 at the Side.

EXAMPLE 6 Writing Numbers in Digits

Rewrite each number using digits.

(a) **six thousand, twenty-two**

6022

With four digits or fewer, *no comma* is needed.

(b) **two hundred fifty-six thousand, six hundred twelve**

256,612

(c) **nine million, five hundred fifty-nine**

9,000,559

Zeros indicate there are no thousands.

◀ Work Problem 6 at the Side.

OBJECTIVE 4 Read a table. A common way of showing number values is by using a **table.** Tables organize and display facts so that they are more easily understood. The following table shows some past facts and future predictions for the United States. These numbers give us a glimpse of what we can expect in the 21st century.

NUMBERS FOR THE 21ST CENTURY

Year	2010	2015	2020*
U.S. population	309 million	325 million	341 million
Household income	$46,326	$54,203	$65,209
Average yearly salary	$28,834	$32,294	$36,169

*Estimated figures

Data from *Family Circle* magazine; U.S. Census Bureau.

If you read from left to right along the row labeled "U.S. population," you find that the population in 2010 was 309 million, then the population in 2015 was 325 million, and the estimated population for 2020 is 341 million.

EXAMPLE 7 Reading a Table

Use the table to find each number, and write the number in words.

(a) The estimated household income in the year 2020

Read from left to right along the row labeled "Household income" until you reach the 2020 column and find $65,209.

Sixty-five thousand, two hundred nine dollars

(b) The average yearly salary in 2010

Read from left to right along the row labeled "Average yearly salary." In the 2010 column you find $28,834.

Remember: Use hyphens when necessary.

Twenty-eight thousand, eight hundred thirty-four dollars

Work Problem 7 at the Side. ▶

Note

Notice in **Example 7** that hyphens are used when writing numbers in words. A hyphen is used when writing the numbers 21 through 99 (twenty-one through ninety-nine), except for numbers ending in zero (20, 30, 40, ... 90).

7 Use the table to find each number, and write the number in digits when it is given in words, or write the number in words when it is given in digits.

GS **(a)** The population in 2015

The U.S. population in the 2015 column is 325 million and is written in digits as 3___ ___ ,000,000

(b) The estimated population in 2020

(c) Household income in 2010

(d) The estimated average yearly salary in 2020

Answers

7. (a) 2; 5; 325,000,000
(b) 341,000,000
(c) forty-six thousand, three hundred twenty-six dollars
(d) thirty-six thousand, one hundred sixty-nine dollars

1.1 Exercises

FOR EXTRA HELP

Go to MyMathLab for worked-out, step-by-step solutions to exercises enclosed in a square and video solutions to ▶ exercises.

CONCEPT CHECK *Choose the letter of the correct response.*

1. The digit in the hundreds place in the whole number 3065 is

(a) 5 **(b)** 3 **(c)** 0 **(d)** 6

2. The digit in the ten-thousands place in the whole number 134,681 is

(a) 6 **(b)** 3 **(c)** 8 **(d)** 1

Write the digit for the given ***place value*** *in each whole number.* ***See Examples 1 and 2.***

3. 18,015
▶ ten-thousands
hundreds

4. 86,332
ten-thousands
ones

5. 7,628,592,183
▶ millions
thousands

6. 1,700,225,016
billions
millions

CONCEPT CHECK *Identify the correct period.*

7. Write the digits in the thousands period in the whole number 552,687,318.

8. Write the digits in the millions period in the whole number 947,321,876,528.

Write the digits for the given ***period*** *(group) in each whole number.* ***See Example 3.***

9. 3,561,435
▶ millions
thousands
ones

10. 100,258,100,006
billions
millions
thousands
ones

11. Do you think the fact that humans have four fingers and a thumb on each hand explains why we use a number system based on ten digits? Explain.

12. The decimal system uses ten digits. Fingers and toes are often referred to as digits. In your opinion, is there a relationship here? Explain.

CONCEPT CHECK *Answer* true *or* false *for each statement.*

13. The number 23,115 is written in words as twenty-three thousand and one hundred and fifteen.

14. The number 37,886 is written in words as thirty-seven thousand, eight hundred eighty-six.

Write each number in words. ***See Examples 4 and 5.***

15. 346,009
GS three hundred forty six _____, _____
▶

16. 218,033
GS two hundred eighteen _____, thirty-_____

17. 25,756,665

18. 999,993,000

Write each number using digits. ***See Example 6.***

19. sixty-three thousand, one hundred sixty-three
GS 6 __, 1 __ __

20. ninety-five thousand, one hundred eleven
GS 9 __, __ __ 1

21. ten million, two hundred twenty-three
▶

22. one hundred million, two hundred

Write the numbers from each sentence using digits. ***See Example 6.***

23. There were seventy-nine million, six hundred eighty thousand avocados used during the celebration of Cinco de Mayo. (Data from History Channel/*Pawn Stars*.)

24. A full-grown caterpillar is 27,000 times its birth size. A 9-pound human baby growing at the same rate would weigh two hundred forty-three thousand pounds by college graduation. (Data from *Spirit Magazine*.)

25. The number of cans of Pepsi Cola sold each day is fifty million, fifty-one thousand, five hundred seven. (Data from *60 Minutes*.)

26. At night, the human eye can see the light from a single candle at a distance of 10 miles (146 football fields), or fifty-two thousand, eight hundred feet. (Data from Centrum Silver Vitamins commercial.)

27. There are fifty-four million, seven hundred fifty thousand Hot Wheels sold each year. (Data from *60 Minutes*.)

28. A middle-income family will typically spend two hundred twenty-one thousand dollars to raise a child to the age of eighteen. (Data from *Los Angeles Times*.)

29. Rewrite eight hundred trillion, six hundred twenty-one million, twenty thousand, two hundred fifteen by using digits.

30. Rewrite 2,353,896,448, the number of vehicles that have crossed the Golden Gate Bridge, in words.

The table at the right shows various ways people get to work. Use the table to answer Exercises 31–34. ***See Example 7.***

31. Which method of transportation is least used? Write the number in words.

32. Which method of transportation is most used? Write the number in words.

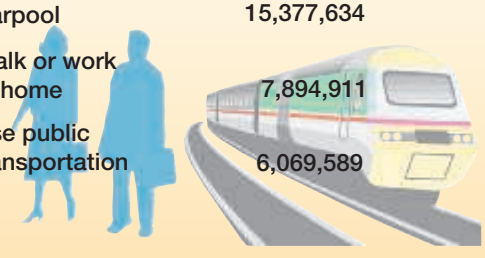
33. Find the number of people who walk to work or work at home, and write it in words.

34. Find the number of people who carpool, and write it in words.

Getting to Work

How workers 16 and over get to work:

Drive alone	84,215,298
Carpool	15,377,634
Walk or work at home	7,894,911
Use public transportation	6,069,589



Data from U.S. Census Bureau.