



# Prealgebra

SIXTH EDITION

LIAL | HESTWOOD

 Pearson

Sixth  
Edition

# Prealgebra

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Sixth  
Edition

# Prealgebra

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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.

This book is also dedicated to my husband, Earl Orf, who is the wind beneath my wings, and to my students at Minneapolis Community and Technical College, from whom I have learned so much.

Diana Hestwood

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# Preface

It is with great pleasure that we offer the sixth edition of *Prealgebra*. We have remained true to the original goal that has guided us over the years—to provide the best possible text and supplements package to help students succeed and instructors teach. Extensive classroom testing has helped us mold what we believe is the most student-friendly and student-focused book on the market—written clearly and accessibly for developmental students, always delivering extra help precisely when needed, and continually reinforcing the ideas that need it most. This edition faithfully continues that process through enhanced explanations of concepts, new and updated examples and exercises, student-oriented features like Vocabulary Tips, Concept Checks, Cautions, Pointers, Relating Concepts, and Guided Solutions, as well as an extensive package of helpful supplements and study aids.

This text is part of a series that also includes

- *Basic College Mathematics*, Tenth Edition, by Lial, Salzman, 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
- *Developmental Mathematics: Basic Mathematics and Algebra*, Fourth Edition, by Lial, Hornsby, McGinnis, Salzman, and Hestwood

## WHAT'S NEW IN THIS EDITION


The scope and sequence of topics in *Prealgebra* has stood the test of time and rates highly with our reviewers. Therefore, you will find the table of contents intact, making the transition to the new edition easier.

- ▶ **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.
- ▶ **Study Skills Reminders** Contextualized activities called Study Skills are integrated into the text itself. To help students get off to a successful start, these activities are located primarily in the first four chapters. Also, in this edition, special Study Skills Reminders have been strategically placed throughout the text (especially in the second half) to encourage students to *revisit* the Study Skills activity most appropriate at that point.
- ▶ **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.


- ▶ **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 improve the quality and quantity of exercises that matter the most to instructors and students.
- ▶ **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. In addition, MyMathLab homework exercises have been refined using analyzed aggregated student usage and performance data.

## 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.
- ▶ **Real-Life Applications** We are always on the lookout for interesting data to use in real-life applications. As a result, we have included many new or updated examples and exercises throughout the text that focus on real-life applications of mathematics. Students are often asked to find data in a table, chart, graph, or advertisement. These applied problems provide an up-to-date flavor that will appeal to and motivate 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** Chapter 3 introduces students to our six-step process for solving application problems algebraically: *Read, Assign a Variable, Write an Equation, Solve, State the Answer, and Check*. Devoting an entire chapter to this process allows students to build a strong foundation for problem solving, which is then reinforced through specific problem-solving examples.
- ▶ **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  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** These color-coded and boxed comments, one of the most popular features of previous editions, warn students about common errors and emphasize important ideas throughout the exposition. Cautions are highlighted in yellow and Notes are highlighted with blue tabs.

 ► **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.



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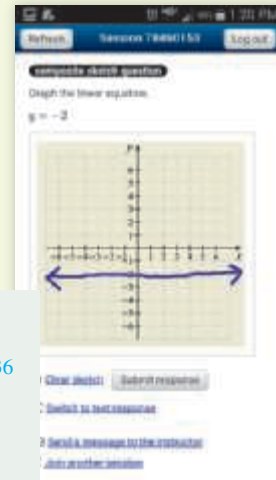
# Resources for Success

## MyMathLab Online Course for Lial/Hestwood *Prealgebra*, 6th 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

- In  $50 \cdot 36$ , what are the numbers 50 and 36 called?
  - products
  - places
  - factors
- Simplify:  $35 \cdot 120$



### 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.

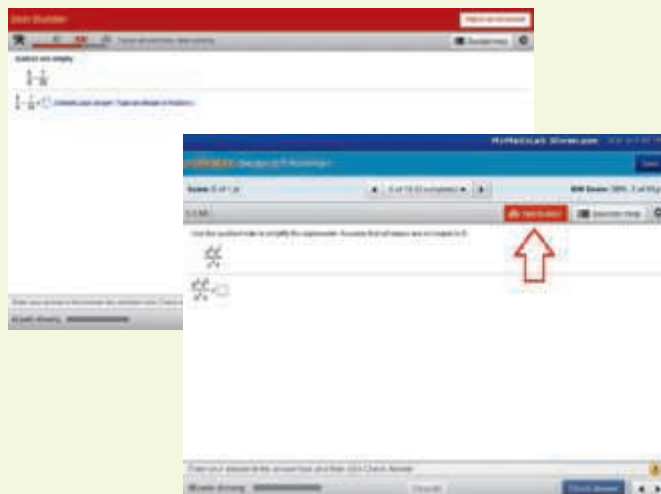




# Resources for Success

## 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:** 0-13-454115-4 **ISBN 13:** 978-0-13-454115-0  
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](http://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 editable slides present key concepts and definitions from the text.

### TestGen

TestGen® ([www.pearsoned.com/testgen](http://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:** 0-13-454103-0 **ISBN 13:** 978-0-13-454103-7  
This manual contains completely worked-out solutions for all the odd-numbered exercises in the text.

### Lial Video Workbook

**ISBN 10:** 0-13-454098-0 **ISBN 13:** 978-0-13-454098-6  
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 text 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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Linda Russell developed and wrote the Study Skills activities that appear throughout this text. She also worked to make the text more readable for developmental-level students, and provided much-needed help throughout the production phase. Her 25+ years of experience teaching reading and study skills to students at this level was invaluable.

We are pleased to welcome Sara Van Asten to our team. She is the math department chair at North Hennepin Community College, and has a special interest and talent for teaching mathematics to developmental-level students. She contributed a great deal to revising and updating application problems, and she wrote new material for Relating Concepts, Learning Catalytics, and What Went Wrong exercises. The insights she has developed from years of teaching at this level were most helpful.

The ultimate measure of this text's success is whether it helps students master algebra 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](mailto:math@pearson.com). We appreciate your feedback!

Diana L. Hestwood

# Pretest: Whole Numbers Computation

## ! CAUTION

This test will check your skills in doing whole numbers computation using paper and pencil. Each part of the test is keyed to a section in the **Whole Numbers Review** chapter, which follows Chapter 10. Based on your test results, work the appropriate section or sections in the Whole Numbers Review chapter *before you begin this course*. You need these skills to be successful!

*Adding Whole Numbers* (Do not use a calculator.)

1. 
$$\begin{array}{r} 368 \\ + 22 \\ \hline \end{array}$$

2. 
$$\begin{array}{r} 7093 \\ + 6073 \\ \hline \end{array}$$

3. 
$$\begin{array}{r} 85 \\ + 2968 \\ \hline \end{array}$$

4.  $57,208 + 915 + 59,387$

5.  $714 + 3728 + 9 + 683,775$

---

*Subtracting Whole Numbers* (Do not use a calculator.)

1. 
$$\begin{array}{r} 426 \\ - 76 \\ \hline \end{array}$$

2. 
$$\begin{array}{r} 3358 \\ - 2729 \\ \hline \end{array}$$

3. 
$$\begin{array}{r} 30,602 \\ - 5708 \\ \hline \end{array}$$

4.  $4006 - 97$

5.  $679,420 - 88,033$

---

*Multiplying Whole Numbers* (Do not use a calculator.)

1.  $3 \times 3 \times 0 \times 6$

2. 
$$\begin{array}{r} 3841 \\ \times 7 \\ \hline \end{array}$$

3.  $(520)(3000)$

(Continued)



**Multiplying Whole Numbers** (Continued)

Do not use a calculator; show your work.

4. 
$$\begin{array}{r} 71 \\ \times 26 \\ \hline \end{array}$$

5. Multiply 359 and 48.

6.  $853 \times 609$

---

**Dividing Whole Numbers** (Do not use a calculator; show your work.)

1.  $3\overline{)69}$

2.  $12 \div 0$

3.  $\frac{25,036}{4}$

4.  $7\overline{)5655}$

5.  $52\overline{)1768}$

6.  $45,000 \div 900$

7.  $38\overline{)2300}$

8.  $83\overline{)44,799}$

Now check your answers on page A–7 in the Answers section. Record the number of problems you worked correctly in each part of the test.

**Adding Whole Numbers:** \_\_\_\_\_ correct out of 5.

If you got 0, 1, or 2 correct, work **Adding Whole Numbers** in the Review chapter.

**Subtracting Whole Numbers:** \_\_\_\_\_ correct out of 5.

If you got 0, 1, or 2 correct, work **Subtracting Whole Numbers** in the Review chapter.

**Multiplying Whole Numbers:** \_\_\_\_\_ correct out of 6.

If you got 0, 1, 2, or 3 correct, work **Multiplying Whole Numbers** in the Review chapter.

**Dividing Whole Numbers:** \_\_\_\_\_ correct out of 8.

If you got 0, 1, or 2 correct, work **Dividing Whole Numbers** and **Long Division** in the Review chapter.

If you got 3 or 4 correct, work **Long Division** in the Review chapter.

# 1



## Introduction to Algebra: Integers

In this chapter, you'll see how we use both *positive* and *negative* numbers. For example, we use them to report temperatures, check our bank account balance, and interpret medical test results.

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

**1.1** Place Value

**Study Skills** *Using Your Text*

**1.2** Introduction to Integers

**Study Skills** *Homework: How, Why, and When*

**1.3** Adding Integers

**1.4** Subtracting Integers

**1.5** Problem Solving: Rounding and Estimating

**1.6** Multiplying Integers

**1.7** Dividing Integers

**Summary Exercises** *Operations with Integers*

**Study Skills** *Taking Lecture Notes*

**1.8** Exponents and Order of Operations

**Study Skills** *Reviewing a Chapter*

**Study Skills** *Managing Your Time*



# 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.

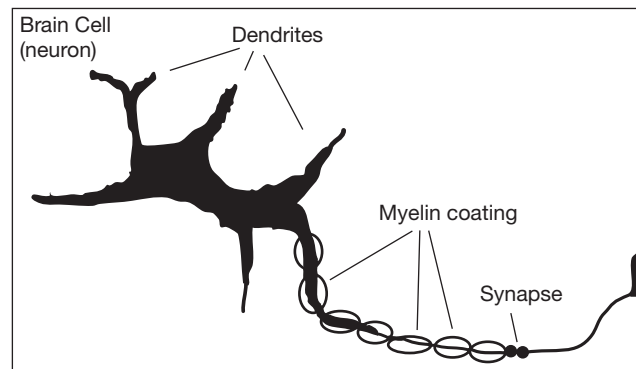
Your brain's outer layer is called the **neocortex**, which is where higher-level thinking, language, reasoning, and purposeful behavior occur. The neocortex has about 100 billion (100,000,000,000) brain cells called **neurons**.

## Learning Something New

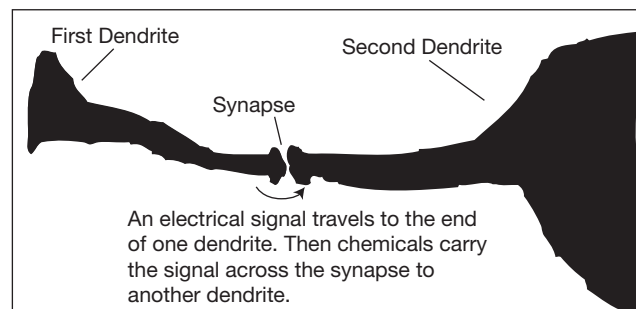
- ▶ As you learn something new, threadlike branches grow out of each neuron. These branches are called **dendrites**.
- ▶ When the dendrite from one neuron grows close enough to the dendrite from another neuron, a connection is made. There is a small gap at the connection point called a **synapse**. 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 gap (synapse) between two dendrites.



- ▶ If 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 helps 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 possible. 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 Place Value

- OBJECTIVES**
- 1 Identify whole numbers.
  - 2 Identify the place value of a digit through hundred-trillions.
  - 3 Write a whole number in words or digits.

It would be nice to earn millions of dollars like some of our favorite entertainers or sports stars. But how much is a million? If you received \$1 every second, 24 hours a day, day after day, how many days would it take for you to receive a million dollars? How long to receive a billion dollars? Or a trillion dollars? Make some guesses and write them here.

It would take \_\_\_\_\_ to receive a million dollars.  
 It would take \_\_\_\_\_ to receive a billion dollars.  
 It would take \_\_\_\_\_ to receive a trillion dollars.

The answers are at the bottom left of the page. Later in this chapter, you'll find out how to calculate the answers.

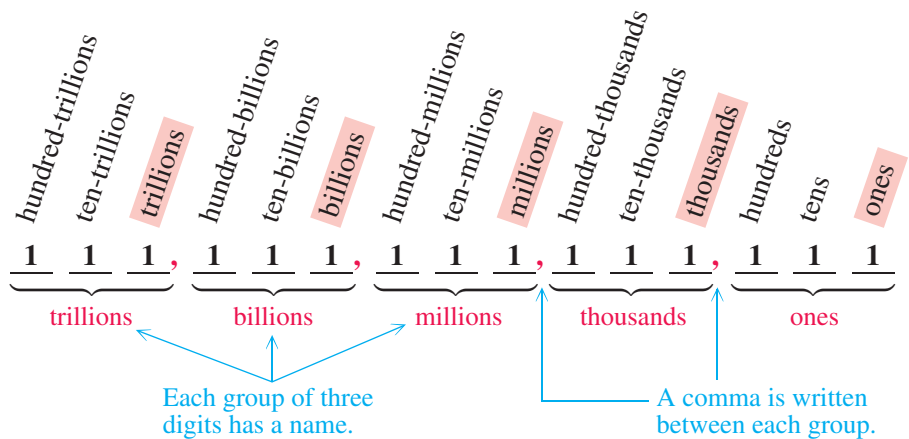
**OBJECTIVE 1 Identify whole numbers.** First we have to be able to write the number that represents *one million*. We can write *one* as 1. How do we make it *1 million*? Our number system is a **place value system**. That means that the location, or place, in which a number is written gives it a different value. Using money as an example, you can see that

- \$1 is one dollar.
- \$10 is ten dollars.
- \$100 is one hundred dollars.
- \$1000 is one thousand dollars.

Each time the 1 moved to the left one place, it was worth *ten times* as much. Can you keep moving it to the left? Yes, as many times as you like.

The chart below shows the *value* of each *place*. In other words, you write the 1 in the correct place to represent the number you want to express. It is important to memorize the place value names shown on the chart.

**Whole Number Place Value Chart**



If there had been more room on this page, we could have continued to the left with quadrillions, quintillions, sextillions, septillions, octillions, and more.

Of course, we can use other *digits* besides 1. In our decimal system of writing numbers, we can use these ten **digits**: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. In this section we will use the digits to write **whole numbers**.

**Make a Strong Start!**

Before you begin this course, take the Whole Numbers Computation Pretest. Based on your test results, work the appropriate sections in the Whole Numbers Review chapter, which follows Chapter 10. You need these skills to succeed in this course.



**VOCABULARY TIP**

**Value** The meaning of the word "value" in mathematics is slightly different than in everyday use. In math, "value" refers to "how much" or "a quantity." You will see the word "value" in many places in this text.

**Answers**

About  $11\frac{1}{2}$  days to receive a million dollars;  
 nearly 32 years to receive a billion dollars;  
 about 31,700 years to receive a trillion dollars.

These are whole numbers.

0 8 37 100 24,014

These are *not* whole numbers.-6  $\frac{3}{4}$  7.528 0.3  $5\frac{2}{3}$ **EXAMPLE 1** Identifying Whole Numbers

Circle the whole numbers in this list.

75 -4 300 1.5  $\frac{5}{8}$  0 0.666  $7\frac{1}{2}$  2

Zero is a whole number.

Whole numbers *do* include zero. If we started a list of *all* the whole numbers, it would look like this: 0, 1, 2, 3, 4, 5, . . . with the three dots indicating that the list goes on and on. So the whole numbers in this example are: **75, 300, 0, and 2.**

Work Problem 1 at the Side. ►

**OBJECTIVE 2** Identify the place value of a digit through hundred-trillions.

The estimated world population in 2016 was 7,394,582,817 people. There are two 7s in this number, but the value of each 7 is very different. The 7 on the right is in the ones place, so its value is simply 7. But the 7 on the left is worth a great deal more because of the *place* where it is written. Looking back at the place value chart, we see that this 7 is in the *billions* place, so its value is *7 billion*.

7, 3 9 4, 5 8 2, 8 1 7 people in the world

↑ Value of 7 billion      ↑ Value of 7 ones

**EXAMPLE 2** Identifying Place Value

Identify the place value of each 8 in the number of people in the world.

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

↑ Ten-thousands place      ↑ Hundreds place

Work Problem 2 at the Side. ►

**OBJECTIVE 3** Write a whole number in words or digits. To write a whole number in words, or to say it aloud, begin at the left. Write or say the number in each group of three, followed by the name for that group. When you get to the ones group, do *not* include the group name. **Hyphens** (dashes) are used whenever you write a number from 21 to 99, like twenty-one thousand, or thirty-seven million, or ninety-four billion.

**EXAMPLE 3** Writing Numbers in Words

(a) Write 6,058,120 in words.

Start at the left.

6, 058, 120

↙ six million, ↘ fifty-eight thousand, ↘ one hundred twenty

Group name      Group name

↙ Do not use the group name "ones."

Do not say "one hundred and twenty" here.

Continued on Next Page

- 1 Circle the whole numbers. (*Hint:* There are five whole numbers.)

0.8 -14 502

 $\frac{7}{9}$  3  $\frac{3}{2}$ 14 0  $6\frac{4}{5}$ 9.082  $-\frac{8}{3}$  60,005**VOCABULARY TIP****Place value** Think of the number 3333.

Each "3" has a different value, even though it is the same digit. The **place** where the 3 is located determines its value: three thousands, three hundreds, three tens, and three ones.

- 2 Identify the place value of the digit 8 in each number. Use the place value chart on the previous page if you need help.

(a) 45,628,665

(b) 800,503,622

(c) 428,000,000,000

(d) 2,835,071

**Answers**

1. 502; 3; 14; 0; 60,005  
 2. (a) thousands (b) hundred-millions  
 (c) billions (d) hundred-thousands

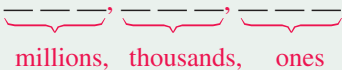
3 Write these numbers in words.

GS (a) 23,605  
 twenty-three \_\_\_\_\_,  
 six hundred \_\_\_\_\_

(b) 400,033,007

(c) 193,080,102,000,000

4 Write each number using digits.

GS (a) Eighteen **million**, two **thousand**, three hundred five  
  
 \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_  
 millions, thousands, ones

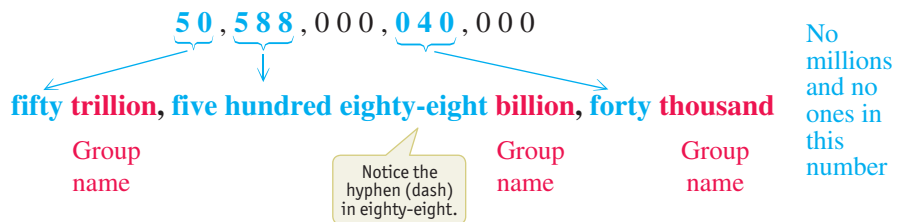
(b) Two hundred billion, fifty million, six hundred sixteen

(c) Five trillion, forty-two billion, nine million

(d) Three hundred six million, seven hundred thousand, nine hundred fifty-nine

(b) Write 50,588,000,040,000 in words.

Start at the left.



**CAUTION**

You often hear people say “and” when reading a group of three digits. For example, you may hear 120 as “one hundred **and** twenty,” but this is **not** correct. The word **and** is used when reading a **decimal point**, which we do not have here. The correct wording for 120 is “one hundred twenty.” See **Example 3(a)**.

◀ Work Problem 3 at the Side.

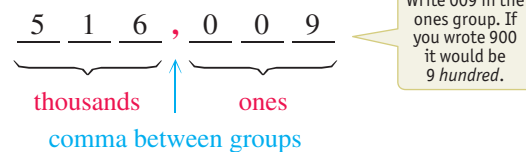
When you read or hear a number and want to write it in digits, look for the group names: **trillion**, **billion**, **million**, and **thousand**. Write the number in each group, followed by a comma. Do **not** put a comma at the end of the ones group.

**EXAMPLE 4 Writing Numbers in Digits**

Write each number using digits.

(a) Five hundred sixteen **thousand**, nine

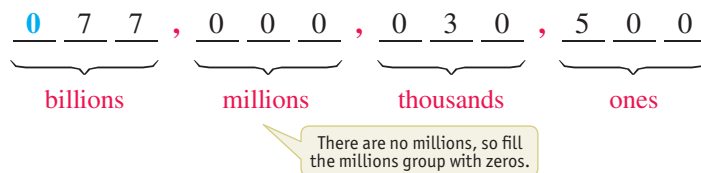
The first group name is *thousand*, so you need to fill *two groups* of three digits: thousands and ones.



The number is **516,009**.

(b) Seventy-seven **billion**, thirty **thousand**, five hundred

The first group name is *billion*, so you need to fill *four groups* of three digits: billions, millions, thousands, and ones.



When writing the number, you can omit the leading 0 in the billions group.

The number is **77,000,030,500**.

◀ Work Problem 4 at the Side.

**Answers**

3. (a) twenty-three **thousand**, six hundred **five thousand**, seven  
 (b) four hundred **million**, thirty-three **thousand**, seven  
 (c) one hundred ninety-three **trillion**, eighty **billion**, one hundred two **million**
4. (a) 18,002,305    (b) 200,050,000,616  
 (c) 5,042,009,000,000    (d) 306,700,959

# 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** In Exercises 1–4, decide whether each statement is true or false. If a statement is false, fix it.

1. The digits we can use to write numbers are 1, 2, 3, 4, 5, 6, 7, 8, and 9.

2. All of these numbers are whole numbers.  
16,565    2    0    400

3. None of these numbers are whole numbers.

$$\frac{7}{10} \quad -21 \quad 0.03 \quad 1\frac{1}{2}$$

4. Each 7 in this number has the same value.  
1,372,075

Circle the whole numbers. See **Example 1**.

5. 15     $8\frac{3}{4}$     0    3.781

6. 33.7    -5    457     $\frac{8}{5}$

83,001    -8     $\frac{7}{16}$      $\frac{9}{5}$

0    6     $1\frac{3}{4}$     -14.1

7. 5.8    -6    7     $\frac{5}{4}$

8. 75,039     $\frac{1}{3}$     -87    6.49

$\frac{1}{10}$     362,049    0.1     $7\frac{7}{8}$

-0.5     $2\frac{7}{10}$      $\frac{15}{8}$     4

Identify the place value of the digit 2 in each number. See **Example 2**.

9. 61,284

10. 82,110

11. 284,100

12. 823,415

13. 725,837,166

14. 442,653,199

15. 253,045,701,000

16. 823,000,419,567

**CONCEPT CHECK** In Exercises 17–18, name the place value for each 0 in the number, going from left to right.

17. 302,016,450,098,570

18. 810,704,069,809,035



**8 Chapter 1** Introduction to Algebra: Integers

In Exercises 19–30, write each number in words. See Example 3.

19. 8421

 eight \_\_\_\_\_, four \_\_\_\_\_ twenty-\_\_\_\_\_

20. 1936

 one \_\_\_\_\_, nine \_\_\_\_\_ thirty-\_\_\_\_\_

21. 46,205



22. 75,089

23. 3,064,801

24. 7,900,408

25. 840,111,003

26. 304,008,401

27. 51,006,888,321



28. 99,046,733,214

29. 3,000,712,000,000



30. 50,918,000,000,600

In Exercises 31–40, write each number using digits. See Example 4.

31. Forty-six thousand, eight hundred five

   
          ,            
          thousands    ones

32. Seventy-nine thousand, forty-six

   
          ,            
          thousands    ones

33. Five million, six hundred thousand, eighty-two

34. One million, thirty thousand, five

35. Two hundred seventy-one million, nine hundred thousand

36. Three hundred eleven million, four hundred

37. Twelve billion, four hundred seventeen million, six hundred twenty-five thousand, three hundred ten

38. Seventy-five billion, eight hundred sixty-nine million, four hundred eighty-eight thousand, five hundred six

39. Six hundred trillion, seventy-one million, four hundred

40. Four hundred forty trillion, thirty-six thousand, one hundred two

In Exercises 41–52, if the number is given in digits, write it in words. If the number is given in words, write it in digits. See Examples 3 and 4.

41. Every second, 9641 tweets are sent on Twitter. (Data from [www.internetlivestats.com](http://www.internetlivestats.com))



42. Every second, 2367 photos are posted to Instagram. (Data from [www.internetlivestats.com](http://www.internetlivestats.com))

43. During a bad winter it cost the state of Minnesota \$130,100,000 to remove snow and ice from the roads. (Data from *Star Tribune*.)

44. Since it started, Nintendo has sold 669,360,000 gaming systems. (Data from [www.ign.com](http://www.ign.com))

45. Bill Gates, the founder of Microsoft, is the richest person in the world. He is worth \$79,200,000,000. (Data from [www.forbes.com](http://www.forbes.com))

46. The founder of Facebook, Mark Zuckerberg, is worth \$33,400,000,000. (Data from [www.forbes.com](http://www.forbes.com))

47. There are seventy-four million, fifty-nine thousand pet cats in the United States. (Data from [www.avma.org](http://www.avma.org))

48. The YouTube video with the most views was watched four million, one hundred sixty-seven thousand, thirty-four times. (Data from [www.youtube.com](http://www.youtube.com))

49. There are 3,005,000 Google searches performed every minute. (Data from [www.internetlivestats.com](http://www.internetlivestats.com))

50. There are 2,401,333 emails sent every second. (Data from [www.internetlivestats.com](http://www.internetlivestats.com))

51. The Mars company makes over fifteen million Snickers candy bars each day. That is more than five billion, four hundred seventy-five million Snickers candy bars in one year! (Data from [www.nbcnews.com](http://www.nbcnews.com))



52. The Mars company makes four hundred million M&M's candies each day. That adds up to one hundred forty-six billion each year. (Data from [www.mymms.com](http://www.mymms.com))