1 Add & Subtract

ONE MAN AGAINST THE FLAMES

Chicago, Illinois **October 9, 1871**

During the summer of 1871, only about $2\frac{1}{2}$ inches of rain fell on the city of Chicago. Called by one historian a "bonfire waiting to be lit," the city was built almost entirely of wood. Miles of pine-block streets and wooden sidewalks were flanked by office buildings and storefronts. Most homes and barns were wooden, and many industrial buildings were filled with flammable materials such as lumber, coal, and paint. The drought had caused small fires throughout the city that summer. On October 8, exhausted firefighters had just finished fighting a blaze on Chicago's West Side. Many of the fire crew had been hospitalized for burns or smoke inhalation, and several fire engines were broken.

That evening while the firefighters slept, flames broke out in the O'Leary barn on Chicago's Southwest Side. The exact cause of the blaze is unknown. Some people claim it started when a cow kicked over a lantern; others say that the hired man dropped his pipe.

Chicago in Flames, lithograph by Currier & Ives

At any rate, the wind spread the fire quickly, consuming two entire blocks by the time firefighters arrived. Soon the flames were completely out of control. Leaping from house to house, the fire burned its way through the South Side of Chicago, jumped the river, and began to destroy the North Side.

Various efforts were made to stop the fire. One story is told about the successful attempt of a brave citizen on the North Side. When he saw the blaze coming, he immediately went to work removing all the dry leaves, picket fences, and board sidewalks that were near his house, as well as all the boards from his front porch steps. He covered his roof with wet blankets and rugs. As the blaze approached, he kept the roof soaked with water by running between his house and well with a bucket. When the well ran dry, he used cider from his cellar. At last the fire began to die down. His home was still safe.

When rain finally extinguished the fire two days later, Chicago was in ruins. It took several years to rebuild the city. Today throughout the United States, National Fire Prevention Week is observed each year during the week of October 9 to commemorate the Great Fire and to emphasize fire safety. People who practice fire prevention and plan for the possibility of a fire can be compared to the prudent man in Proverbs 27:12 who "foreseeth the evil, and hideth himself." What are some things you can do to help prevent fires and to keep yourself and others safe in the event of a fire?

Contributions poured into Chicago after the fire, giving the city $50 million to spend on rebuilding within a year.

The fire resulted in stricter fire codes and better construction of buildings.

The time immediately following the fire is called the Great Rebuilding of 1871–73.

The first paid fire department in the American colonies was founded in Boston in 1679.

The protective clothing that firemen wear and the equipment that they carry weigh an average of 50–75 pounds.

Some modern pump trucks can dispense more than 1,500 gallons of water per minute.

Add & Subtract

Lesson	Topic	Lesson Objectives
1	**Whole Number Place Value**	• Demonstrate an understanding of place value • Express numbers in standard form, word form, expanded form, and expanded form with multiplication • Identify the value of the digits in a number • Compare numbers using >, <, or = • Round numbers to the place of greatest value or to a given place
2	**Add Whole Numbers**	• Apply addition strategies for mental math • Add whole numbers • Estimate the sum by rounding or using front-end estimation • Solve addition word problems
3	**Subtract Whole Numbers**	• Apply the Zero Principle of Subtraction • Subtract whole numbers • Estimate the difference by rounding or using front-end estimation • Solve subtraction word problems • Check a subtraction problem, using addition
4	**Decimal Place Value**	• Demonstrate an understanding of decimal place value • Express decimals in standard form, word form, fraction form, expanded form, and expanded form with multiplication • Identify the value of the digits in a number • Compare and order decimals • Round decimals to the place of greatest value or to a given place
5	**Add & Subtract Decimals**	• Apply addition properties to decimals: Commutative Property, Identity Property, and Associative Property • Add and subtract decimals • Estimate sums and differences • Check a subtraction problem, using addition
6	**Solving Problems**	• Demonstrate an understanding of the inverse relationship between addition and subtraction • Use a part-whole model to solve addition and subtraction word problems • Write an equation for a word problem • Solve multi-step word problems
7	**Positive & Negative Numbers**	• Compare and order positive and negative numbers • Identify the number that is 1 more or 1 less • Plot positive and negative numbers on a number line • Add positive and negative numbers using a number line
8	**Roman Numerals**	• Read and write Roman numerals • Complete a sequence of Roman numerals
9	**Patterns**	• Use logic to identify number patterns • Use a pattern to solve a problem
10	**Chapter 1 Review**	• Review
11	**Chapter 1 Test Grade 5 Review**	• Add, subtract, multiply, and divide whole numbers • Solve equations with variables • Determine the perimeter and the area of polygons • Add decimals • Identify the mathematical expression for a word phrase • Identify the fraction represented by a picture or a number line • Measure to the nearest inch or half inch • Identify the standard form of a whole number or a decimal written in expanded form

Chapter Materials

Teaching Visuals (Teacher's Toolkit CD):
- Chart 1: Roman Numerals

Teacher Manipulatives Packet:
- Place Value Pocket Chart Kit
- Decimal Place Value Pocket Chart Kit
- Place Value Kit
- Money Kit
- Number Line
- Thermometer and Red Strip
- Roman Numeral Clock

Student Manipulatives Packet:
- Decimal Place Value Pocket Chart Kit
- Money Kit (optional)
- Number Line

Instructional Aids (Teacher's Toolkit CD):
- Decimal Number Lines (page IA1)
- Part-Whole Models (page IA2)
- Problem-Solving Plan (page IA3)
- Positive & Negative Number Line (page IA4)
- Roman Numerals (page IA5)
- Roman Numeral Sequences (page IA6) for each student
- Number Patterns (page IA7)
- Patterns (page IA8)
- Patterns (page IA8) for each student
- Cumulative Review Answer Sheet (page IA9) for each student

Christian Worldview Shaping (Teacher's Toolkit CD):
- Pages 1–3

Other Teaching Aids:
- An apple
- A small sharp knife
- A Bible
- An overhead calculator
- A calculator for each student (optional)

Math 6 Tests and Answer Key

Optional (Teacher's Toolkit CD):
- Fact Review pages
- Application pages
- Calculator Activities

As you prepare the lessons, you will want to refer to the corresponding Instructional Aids pages located on the Teacher's Toolkit CD. If a page is not specified for the student's or teacher's use in the Chapter Materials list above, you should prepare the page for display.

The Charts and some of the visuals from the Math 4–6 Teacher Manipulatives Packet are located in the Teaching Visuals section of the Teacher's Toolkit CD. Copies of the visuals may be prepared by home educators or by classroom teachers for individual or classroom (group) use.

A Little Extra Help

Use the following to provide "a little extra help" for the student that is experiencing difficulty with the concepts taught in Chapter 1.

Line up columns—To help the student keep the place value columns aligned, allow him to use graph paper or to turn his notebook paper sideways so that the lines form columns.

Round to the place of greatest value—Write 350 for display and ask the student to tell the number of tens that are in 350. *35 tens* Underline the 35 in 350. Ask the student to identify the hundreds that 350 comes between *300 and 400* and the number of tens that are in each hundred *30 tens and 40 tens*. Write the student's answers as shown below, underlining the 30 in 300 and the 40 in 400. Explain to the student that he needs to focus only on the first 2 digits of the number to round the number to the place of greatest value. Ask him to tell whether 35 tens rounds up to 40 tens or down to 30 tens and instruct him to explain why. *Up to 40 tens; elicit that since 35 tens is halfway between 30 tens and 40 tens, 35 tens rounds up to 40 tens.* Follow a similar procedure for 3,500 and 35,000.

400	*40 tens*	*4,000*	*40 hundreds*	*40,000*	*40 thousands*
350	*35 tens*	3,500	*35 hundreds*	35,000	*35 thousands*
300	*30 tens*	*3,000*	*30 hundreds*	*30,000*	*30 thousands*

Math Notebook

A math notebook with a divider for each section is recommended for the student to use throughout the school year. The student should have at least four sections in his notebook:

- Paper for recording examples and activities during the daily Math lessons
- Instructional Aids pages completed during the daily Math lessons
- A Journal section containing paper for completing problems indicated by the J symbol on the Student Text pages
- Paper for completing Student Text pages

Math Facts

Throughout this chapter, review addition and subtraction facts using Fact Review pages or a Fact Fun activity on the Teacher's Toolkit CD, or you may use flashcards.

Daily Review

The exercises in the Daily Review section, pages 401–67, of the Student Text provide a systematic review of skills and concepts taught or practiced in fifth grade or in an earlier chapter of sixth grade. The Daily Review assignment listed at the beginning of the lesson does not need to be included as part of the scheduled math lesson and may be completed at any time independently. The answer key for the Daily Review exercises is in this Teacher's Edition and on the Teacher's Toolkit CD.

Solutions

Most answers for the Student Text lesson pages appear in the answer overprint on the reduced pages in each lesson of this Teacher's Edition. Answers that do not fit on the reduced pages are provided in the Solutions section of this Teacher's Edition as well as on the Teacher's Toolkit CD. The CD Solutions section also includes the long-division process, partial-products multiplication, and optional drawings used for solving problems on Student Text pages.

Lesson 1

Student Text pp. 2–5

Daily Review p. 402a

Objectives

- Demonstrate an understanding of place value
- Express numbers in standard form, word form, expanded form, and expanded form with multiplication
- Identify the value of the digits in a number
- Compare numbers using >, <, or =
- Round numbers to the place of greatest value or to a given place

Teacher Materials

- Place Value Pocket Chart Kit

Notes

The Application pages, located on the Teacher's Toolkit CD, provide individualized activities for the student. Preview the pages and select pages that are appropriate for use with Chapter 1. Also preview the Fact Review pages and the Calculator Activities located on the Teacher's Toolkit CD.

Visuals and manipulatives aid in the understanding of math concepts. In preparation for this course, you may choose to review math concepts taught throughout Math 6 by accessing virtual manipulatives online. An Internet search will provide you with a variety of choices for review using manipulatives.

Introduce the Lesson

Guide the students in reading aloud the story and facts on pages 2–3 of the Student Text (pages xxxii, 1 of this Teacher's Edition).

Teach for Understanding

Demonstrate an understanding of place value

1. Explain that our number system is a base ten system. Numbers are formed using 10 digits (0–9), and place values are based on powers of 10. Each place has a value that is 10 times greater than the place to its right and $\frac{1}{10}$ of the value of the place to its left.
2. Display the Place Value Pocket Chart. Point out that commas separate the periods on the chart.
   ➤ **What periods are shown on this place value chart?** ***Millions, Thousands, Ones***
   ➤ **What pattern of places is in each period?** ***Hundreds, Tens, Ones***
3. Insert a 7 in the Tens place of the chart.
   ➤ **What is the value of the 7?** ***70***
   Move the 7 to the Hundreds place.
   ➤ **What is the value of the 7 now?** ***700***
   ➤ **How much greater is the value of 7 when it is in the Hundreds place than when it is in the Tens place?** ***10 times greater***
   Move the 7 to the Ones place.
   ➤ **What is the value of the 7 now?** ***7***
   ➤ **What part of the value of 7 in the Tens place is the value of 7 when it is in the Ones place? How do you know?** ***$\frac{1}{10}$; 7 is $\frac{1}{10}$ of 70***
4. Repeat the procedure using three adjacent places on the chart. Emphasize that each place has a value 10 times greater than the place to its right and a value $\frac{1}{10}$ of the place to its left.
5. Write a 12-digit whole number for display.
   ➤ **What period is to the left of the Millions period?** ***Billions***
   Choose a student to read the number aloud. Remind the students that you say the period name at the end of each period, except for the Ones period, and that you do not use the word *and* between places or periods.
   ➤ **How can you change this number so that there is 1,000 more?** ***Change the digit in the One Thousands place to the next greater digit.***
   (***Note:*** If the digit is 9, you will need to rename 10 One Thousands as 1 Ten Thousand and 0 One Thousands.)
   Choose a student to change the 12-digit number and to read aloud the new number.
   Select another student to add 100,000 to the original number and to read aloud the new number.
6. Follow a similar procedure to add 1 to or subtract 1 from various places in the original number.

Express numbers in different forms

1. Write 503,017,246 for display and choose a student to read the number aloud. Explain that the *standard form* is the most common form used to write a number, but numbers can also be written in other forms. The *word form* is written with words; the period name is written at the end of each period followed by a comma, except for the Ones period.
   ➤ **How could you write the number in the Millions period in word form?** ***five hundred three million*** **Thousands period?** ***seventeen thousand*** **Ones period?** ***two hundred forty-six*** Write the word form as it is given.
2. Explain that writing a number in *expanded form* is a way to decompose or break down a number by showing the value of each digit. Elicit the expanded form for 503,017,246.
   500,000,000 + 3,000,000 + 10,000 + 7,000 + 200 + 40 + 6
   (***Note:*** Zero may be written as a placeholder.)
3. Explain that 503,017,246 can also be written in *expanded form with multiplication*. The value of each place is multiplied by the corresponding digit.
   ➤ **What mathematical phrase can you write for the value of 5 in the Hundred Millions place?** ***(5 × 100,000,000)***
   Write the phrase for display and elicit the phrase for the value of each digit in the remaining places. ***+ (3 × 1,000,000) + (1 × 10,000) + (7 × 1,000) + (2 × 100) + (4 × 10) + (6 × 1)***
4. Instruct the students to write these numbers on paper in all four forms.

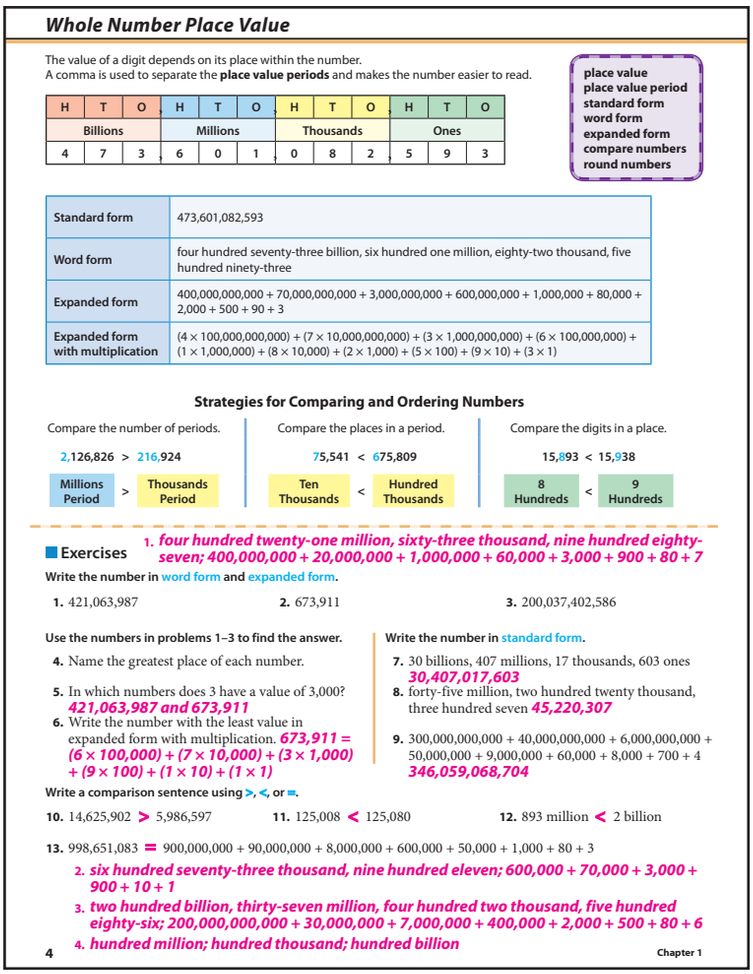
   34,056,230,800 9,720,480,056 34,500,872

Compare numbers

➤ **How can you compare whole numbers that have differing numbers of digits?** ***The number with more digits is greater.*** **with the same number of digits?** ***Elicit that you can begin with the place of greatest value and compare the digits in each place until the digits in a place have different values; the digit with the greater value indicates the greater number.***

1. Guide the students in completing these number sentences; use strategies such as rewriting a number in standard form or comparing corresponding places when the number is written in word form or expanded form.

   84,769,320 > 84,768,320
   103,278,600 > 99,846,759
   20,040,570 < 20,000,000 + 400,000 + 500 + 70
   twelve billion, fifty-three million, twenty-nine > 12,053,029



Whole Number Place Value

The value of a digit depends on its place within the number.
A comma is used to separate the **place value periods** and makes the number easier to read.

place value
place value period
standard form
word form
expanded form
compare numbers
round numbers

H	T	O	H	T	O	H	T	O	H	T	O
Billions			Millions			Thousands			Ones		
4	7	3	6	0	1	0	8	2	5	9	3

Standard form	473,601,082,593
Word form	four hundred seventy-three billion, six hundred one million, eighty-two thousand, five hundred ninety-three
Expanded form	400,000,000,000 + 70,000,000,000 + 3,000,000,000 + 600,000,000 + 1,000,000 + 80,000 + 2,000 + 500 + 90 + 3
Expanded form with multiplication	(4 × 100,000,000,000) + (7 × 10,000,000,000) + (3 × 1,000,000,000) + (6 × 100,000,000) + (1 × 1,000,000) + (8 × 10,000) + (2 × 1,000) + (5 × 100) + (9 × 10) + (3 × 1)

Strategies for Comparing and Ordering Numbers

Compare the number of periods.
2,126,826 > 216,924
Millions Period > Thousands Period

Compare the places in a period.
75,541 < 675,809
Ten Thousands < Hundred Thousands

Compare the digits in a place.
15,893 < 15,938
8 Hundreds < 9 Hundreds

Exercises

1. *four hundred twenty-one million, sixty-three thousand, nine hundred eighty-seven; 400,000,000 + 20,000,000 + 1,000,000 + 60,000 + 3,000 + 900 + 80 + 7*

Write the number in word form and expanded form.

1. 421,063,987
2. 673,911
3. 200,037,402,586

Use the numbers in problems 1–3 to find the answer.

4. Name the greatest place of each number.
5. In which numbers does 3 have a value of 3,000? *421,063,987 and 673,911*
6. Write the number with the least value in expanded form with multiplication. *673,911 = (6 × 100,000) + (7 × 10,000) + (3 × 1,000) + (9 × 100) + (1 × 10) + (1 × 1)*

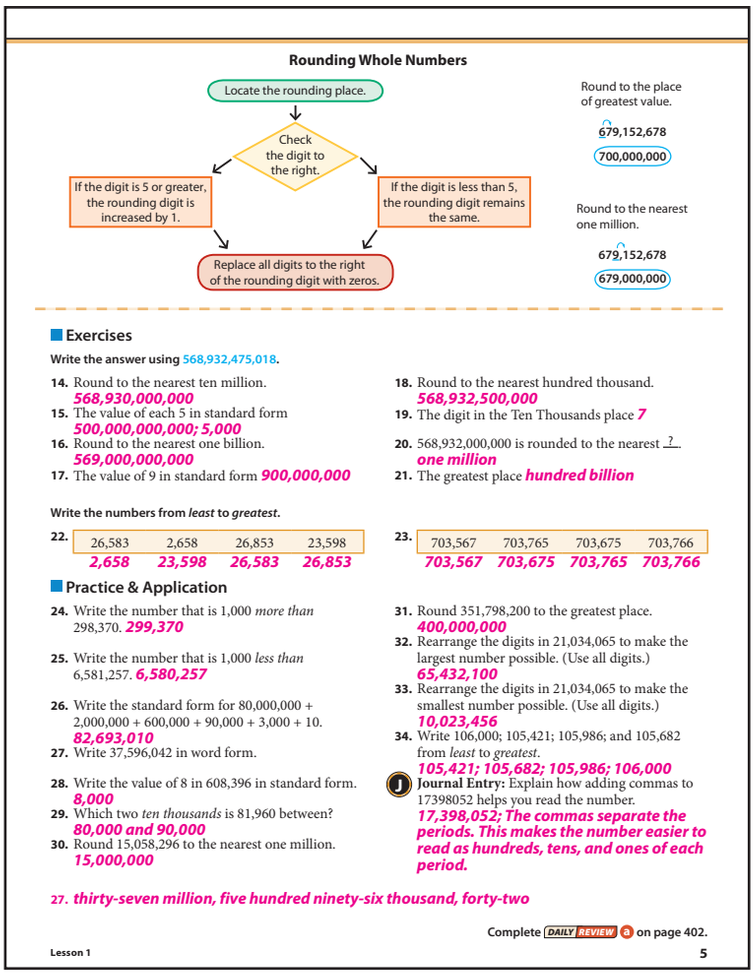
Write the number in standard form.

7. 30 billions, 407 millions, 17 thousands, 603 ones *30,407,017,603*
8. forty-five million, two hundred twenty thousand, three hundred seven *45,220,307*
9. 300,000,000,000 + 40,000,000,000 + 6,000,000,000 + 50,000,000 + 9,000,000 + 60,000 + 8,000 + 700 + 4 *346,059,068,704*

Write a comparison sentence using >, <, or =.

10. 14,625,902 > 5,986,597
11. 125,008 < 125,080
12. 893 million < 2 billion
13. 998,651,083 = 900,000,000 + 90,000,000 + 8,000,000 + 600,000 + 50,000 + 1,000 + 80 + 3

2. *six hundred seventy-three thousand, nine hundred eleven; 600,000 + 70,000 + 3,000 + 900 + 10 + 1*
3. *two hundred billion, thirty-seven million, four hundred two thousand, five hundred eighty-six; 200,000,000,000 + 30,000,000 + 7,000,000 + 400,000 + 2,000 + 500 + 80 + 6*
4. *hundred million; hundred thousand; hundred billion*



Rounding Whole Numbers

Round to the place of greatest value.
679,152,678
700,000,000

Round to the nearest one million.
679,152,678
679,000,000

Exercises

Write the answer using 568,932,475,018.

14. Round to the nearest ten million. *568,930,000,000*
15. The value of each 5 in standard form *500,000,000,000; 5,000*
16. Round to the nearest one billion. *569,000,000,000*
17. The value of 9 in standard form *900,000,000*
18. Round to the nearest hundred thousand. *568,932,500,000*
19. The digit in the Ten Thousands place *7*
20. 568,932,000,000 is rounded to the nearest ? *one million*
21. The greatest place *hundred billion*

Write the numbers from *least* to *greatest*.

22. 26,583 2,658 26,853 23,598 — *2,658 23,598 26,583 26,853*
23. 703,567 703,765 703,675 703,766 — *703,567 703,675 703,765 703,766*

Practice & Application

24. Write the number that is 1,000 *more than* 298,370. *299,370*
25. Write the number that is 1,000 *less than* 6,581,257. *6,580,257*
26. Write the standard form for 80,000,000 + 2,000,000 + 600,000 + 90,000 + 3,000 + 10. *82,693,010*
27. Write 37,596,042 in word form.
28. Write the value of 8 in 608,396 in standard form. *8,000*
29. Which two *ten thousands* is 81,960 between? *80,000 and 90,000*
30. Round 15,058,296 to the nearest one million. *15,000,000*
31. Round 351,798,200 to the greatest place. *400,000,000*
32. Rearrange the digits in 21,034,065 to make the largest number possible. (Use all digits.) *65,432,100*
33. Rearrange the digits in 21,034,065 to make the smallest number possible. (Use all digits.) *10,023,456*
34. Write 106,000; 105,421; 105,986; and 105,682 from *least* to *greatest*. *105,421; 105,682; 105,986; 106,000*

J **Journal Entry:** Explain how adding commas to 17398052 helps you read the number. *17,398,052; The commas separate the periods. This makes the number easier to read as hundreds, tens, and ones of each period.*

27. *thirty-seven million, five hundred ninety-six thousand, forty-two*

Complete DAILY REVIEW a on page 402.

2. Write *a* __ *b* for display. Explain that the variables *a* and *b* represent 2 values to be compared. Assign the following values to *a* and *b* and guide the students in comparing them. Select students to explain the answers.

   a is a 7-digit whole number; *b* is a 9-digit whole number **a < b; *one millions are less than hundred millions***

   a = 367,000,000; *b* = 365,000,000 **a > b**

   a = 2,000,000 + 6,000; *b* = 2,000,000 + 60,000 **a < b**

Round numbers

1. Write 354,829 for display. Explain that you want to round 354,829 to the place of greatest value. Choose a student to underline the digit in the place of greatest value. *3*

   ➤ **Which hundred thousands is 354,829 between? *300,000 and 400,000*** Write the two rounding possibilities above and below 354,829.

2. Draw a number line with a mark close to each end and at the halfway point. Label the left mark 300,000 and the right mark 400,000.

   ➤ **What number is halfway between 300,000 and 400,000? Why? *350,000; 50,000 is half of 100,000, so 350,000 is halfway between 300,000 and 400,000.***

   Label the halfway point 350,000. Choose a student to draw and label a point at the approximate location of 354,829.

   ➤ **Which hundred thousand does 354,829 round to? Why? *400,000; 354,829 > 350,000***

3. Follow a similar procedure to round these numbers to the given place.

   354,829 rounded to the nearest ten thousand ***between 350,000 and 360,000; rounds to 350,000***

   1,465,309 rounded to the nearest one thousand ***between 1,465,000 and 1,466,000; rounds to 1,465,000***

   378,720,526,482 rounded to the nearest ten billion ***between 370,000,000,000 and 380,000,000,000; rounds to 380,000,000,000***

   ➤ **How does the value of the digit to the right of the rounding place help you to round a number? *Elicit that if the digit to the right of the rounding place is 5 or more, you round up, increasing the rounding place by 1; if the digit is less than 5, you round down, leaving the rounding place unchanged. Replace digits to the right of the rounding place with zeros.***

Student Text pp. 4–5

Throughout Math 6, use the information given on the Student Text pages to review the concepts taught in the lesson and allow the students to complete a few practice problems with you, if needed, before they complete the remaining problems independently.

For your convenience, a printable version of the Daily Reviews are included on the Teacher's Toolkit CD. We have included room on these pages for students to show their work, so the order and numbering may differ from the Student Text. An answer key for these pages is also available on the CD.

Lesson 2 **Student Text** pp. 6–7
Daily Review p. 402b

Objectives
- Apply addition strategies for mental math
- Add whole numbers
- Estimate the sum by rounding or using front-end estimation
- Solve addition word problems

Teacher Materials
- Place Value Kit

Teach for Understanding

Apply addition strategies for mental math

1. Write 3 + 7 = 10 and 7 + 3 = 10 for display.

➤ **What other addition facts do you know that equal 10?** ***0 + 10; 10 + 0; 1 + 9; 9 + 1; 2 + 8; 8 + 2; 4 + 6; 6 + 4; 5 + 5***

2. Write 23 + 7 = ___ and 3 + 47 = ___ for display.

   Choose students to complete the equations, using mental math, and to explain how they calculated the answers. ***30; 50***
   Remind the students that using addition facts to make tens can help them to easily add mentally.

3. Write 23 + 84 = ___ and 56 + 57 = ___ for display.

➤ **How does knowing the "ten" facts help you to solve problems like these mentally?** ***Accept any reasonable answers, but elicit that you can easily add the tens to make 10 tens or 100 and then add the sum of the ones to 100.***

   Select students to complete the equations and explain how they calculated the answers mentally. ***Think 2 tens + 8 tens = 100, 100 + (3 + 4) = 107; think 5 tens + 5 tens = 100, 100 + (6 + 7) = 113.***

4. Explain that when adding mentally it is often easier to add from left to right, adding the value of each place and making adjustments for any renaming as you add. Guide the students in solving these problems from left to right, mentally adding each place and making adjustments for any renaming.

   4,276 + 372 = ___ ***Think 4,000 + (200 + 300) = 4,500; 4,500 + (70 + 70) = 4,640; 4,640 + (6 + 2) = 4,648.***

   790,234 + 4,823 + 587 = ___ ***Think 790,000 + 4,000 = 794,000; 794,000 + (200 + 800 + 500) = 795,500; 795,500 + (30 + 20 + 80) = 795,630; 795,630 + (4 + 3 + 7) = 795,644.***

5. Point out that *compensation*, subtracting an amount from one addend and adding the same amount to another addend to make the other addend a ten, can help in adding more quickly. Guide the students in mentally solving these problems using compensation.

   45 + 13,005 = ___ ***Think (45 + 5) + (13,005 − 5) = 50 + 13,000 = 13,050.***

   634 + 76 = ___ ***Think (634 − 4) + (76 + 4) = 630 + 80 = 710 or (634 + 6) + (76 − 6) = 640 + 70 = 710.***

6. Direct the students to choose any strategy to solve these equations using mental math. Point out that there is not a right or wrong strategy.

   9,034 + 72 = ___ ***9,106***

   851 + 249 = ___ ***1,100***

   376,000 + 19 + 4,001 = ___ ***380,020***

Estimate sums; add 4-digit numbers

During a 2-day karate tournament, 1,465 tickets were sold on the first day and 2,780 tickets were sold on the second day. How many tickets were sold for the tournament? ***4,245 tickets***

➤ **What equation can you write to solve this word problem?** ***1,465 + 2,780 = ___***

1. Write 1,465 + 2,780 = *t* for display. Remind the students that the variable *t* represents the unknown number of tickets that were sold. Point out that any letter can be used as a variable. (***Note:*** Whenever a variable has been used in a lesson, encourage the students to use a variable when giving an equation to solve other word problems.)

➤ **Why would it be helpful to estimate the sum?** ***Elicit to find an approximate answer or to determine whether your exact answer is reasonable.***

➤ **How would you estimate the number of tickets sold for the tournament?** ***Round the addends to the place of greatest value, the nearest one thousand.***

➤ **Approximately how many tickets were sold? How do you know?** ***4,000; elicit that 1,465 rounds down to 1,000 and 2,780 rounds up to 3,000, resulting in an estimated sum of 4,000.***

   Explain that when both addends are rounded up your estimate will be greater than your exact answer, and when both addends are rounded down your estimate will be less than your exact answer. For this estimate, the first addend was rounded down by 400–500, and the second addend was rounded up by 200–300. Since you rounded the first addend down approximately 200 more than you rounded the second addend up, your exact answer should be approximately 200 more than your estimated answer. Elicit the adjusted estimate. ***4,200***

2. Explain that an adjusted, or closer, estimate can also be found by rounding to a lesser place. Guide the students in estimating the number of tickets sold by rounding to the nearest hundred. ***4,300***

➤ **Will the actual answer be greater or less than this estimate? Why?** ***Less; we rounded up both addends.***

3. Write 1,465 + 2,780 = ___ in vertical form. Display the addends using ones, tens, hundreds, and one thousands from the Place Value Kit.

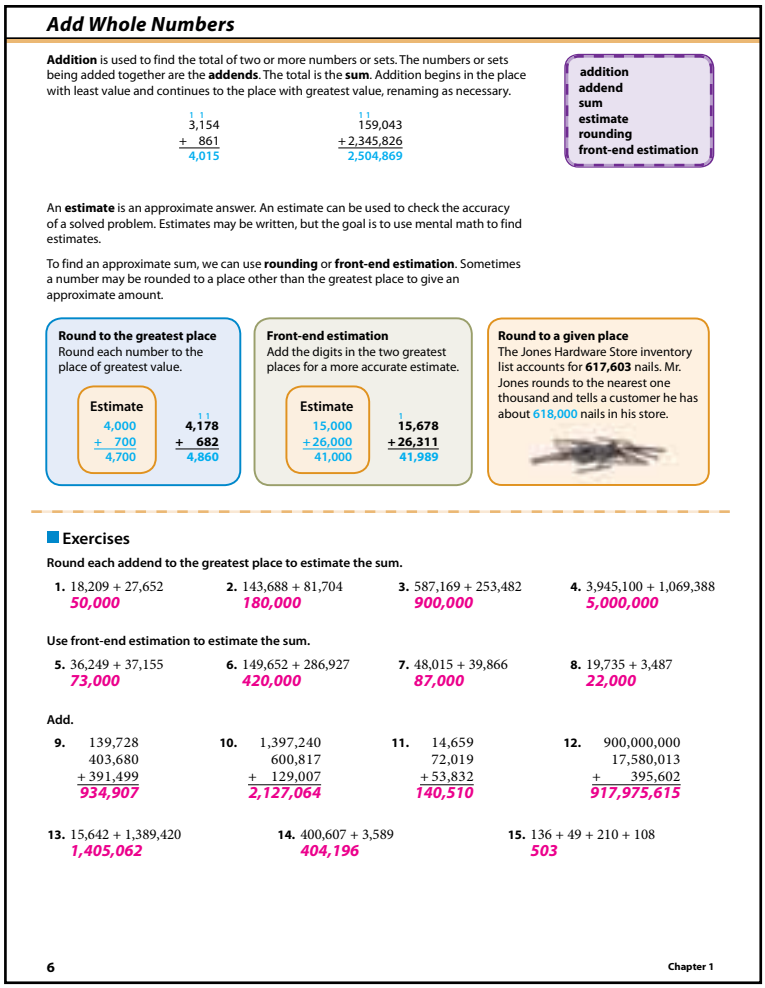
   Choose a student to combine the ones. Discuss whether renaming is needed.

4. Follow a similar procedure to add the remaining places. Emphasize the renaming of the tens and hundreds.

➤ **How many tickets were sold for the tournament?** ***4,245 tickets*** **Is this answer reasonable?** ***yes*** Complete the equation.

5. Write these problems for display. Direct the students to estimate the sums before solving the problems on paper.

1,208	3,047	1,649
+ 964	+ 1,275	+ 2,378
2,172	***4,322***	***4,750***
(2,000)	***(4,000)***	***(4,700)***



Add Whole Numbers

Addition is used to find the total of two or more numbers or sets. The numbers or sets being added together are the **addends**. The total is the **sum**. Addition begins in the place with least value and continues to the place with greatest value, renaming as necessary.

$$\begin{array}{r} {\scriptstyle 1\ 1}\\ 3{,}154\\ +\ \ 861\\ \hline 4{,}015 \end{array} \qquad \begin{array}{r} {\scriptstyle 1\ 1}\\ 159{,}043\\ +2{,}345{,}826\\ \hline 2{,}504{,}869 \end{array}$$

addition
addend
sum
estimate
rounding
front-end estimation

An **estimate** is an approximate answer. An estimate can be used to check the accuracy of a solved problem. Estimates may be written, but the goal is to use mental math to find estimates.

To find an approximate sum, we can use **rounding** or **front-end estimation**. Sometimes a number may be rounded to a place other than the greatest place to give an approximate amount.

Round to the greatest place
Round each number to the place of greatest value.

Estimate	
4,000	4,178
+ 700	+ 682
4,700	4,860

Front-end estimation
Add the digits in the two greatest places for a more accurate estimate.

Estimate	
15,000	15,678
+26,000	+26,311
41,000	41,989

Round to a given place
The Jones Hardware Store inventory list accounts for **617,603** nails. Mr. Jones rounds to the nearest one thousand and tells a customer he has about 618,000 nails in his store.

Exercises

Round each addend to the greatest place to estimate the sum.

1. 18,209 + 27,652 — *50,000*
2. 143,688 + 81,704 — *180,000*
3. 587,169 + 253,482 — *900,000*
4. 3,945,100 + 1,069,388 — *5,000,000*

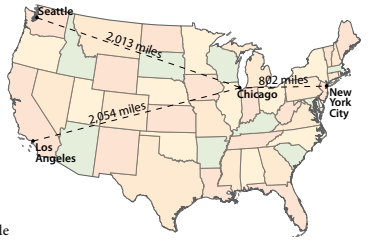
Use front-end estimation to estimate the sum.

5. 36,249 + 37,155 — *73,000*
6. 149,652 + 286,927 — *420,000*
7. 48,015 + 39,866 — *87,000*
8. 19,735 + 3,487 — *22,000*

Add.

9. 139,728 + 403,680 + 391,499 = *934,907*
10. 1,397,240 + 600,817 + 129,007 = *2,127,064*
11. 14,659 + 72,019 + 53,832 = *140,510*
12. 900,000,000 + 17,580,013 + 395,602 = *917,975,615*
13. 15,642 + 1,389,420 = *1,405,062*
14. 400,607 + 3,589 = *404,196*
15. 136 + 49 + 210 + 108 = *503*

Use the map to find the answer.



16. Mr. Johnson flew from his hometown of Los Angeles on a business trip. He flew to Chicago and then from Chicago to New York City. What was the total distance of his flights? *2,054 + 802 = 2,856 mi*
17. Mr. Brown was meeting Mr. Johnson in New York City. How far did Mr. Brown fly if he flew from Seattle to Chicago and then from Chicago to New York City? *2,013 + 802 = 2,815 mi*
18. Estimate the number of miles flown by Mr. Johnson and Mr. Brown. *3,000 + 3,000 = 6,000 mi*
19. Find the number of miles Mr. Johnson flew while making a round trip (flying to the meeting and then flying home). *2,856 + 2,856 = 5,712 mi*

Practice & Application

20. Add commas to 20043170. *20,043,170*
21. Write the name of the greatest place in the number for problem 20. *Ten Millions place*
22. Write 18,396,470,502 in expanded form.
23. Write *six hundred forty-nine thousand, five hundred seventeen* in standard form. *649,517*
24. Write the value of 9 in 19,325,644 in word form. *nine million*
25. Write two facts with a sum of 12 using different addends for each fact. *Answers may vary. 5 + 7 = 12; 8 + 4 = 12*
26. Find the sum of 94, 87, 57, and 19. *257*
27. Find the sum of 903,871 and 89,532. *993,403*
28. Write the number that is 1,000 *more than* 329,990. *330,990*
29. Write a number sentence using the *greater than* symbol to compare the numbers 300,999 and 309,900. *309,900 > 300,999*
30. Write 2,291,620; 2,291,206; 2,921,260; and 2,291,026 from *greatest* to *least*. *2,921,260; 2,291,620; 2,291,206; 2,291,026*
31. Round 1,398,750 to the nearest hundred thousand. *1,400,000*
32. Round 7,521,024,308 to the greatest place. *8,000,000,000*
33. Write the next eight numbers for the *count by 6* pattern: 6, 12, 18, 24. *30, 36, 42, 48, 54, 60, 66, 72*

Journal Entry: Estimate the sum of 158,341 and 211,977 by rounding to the greatest place. *200,000 + 200,000 = 400,000*

Journal Entry: Estimate the sum of 158,341 and 211,977 by front-end estimation. *150,000 + 210,000 = 360,000*

Journal Entry: Explain why using front-end estimation for the addends 158,341 and 211,977 gives a more accurate estimate than rounding to the greatest place. Find the sum. *Rounding to the place of greatest value gives an overestimate of about 30,000. Front-end estimation gives an underestimate of about 10,000. 158,341 + 211,977 = 370,318*

22. *10,000,000,000 + 8,000,000,000 + 300,000,000 + 90,000,000 + 6,000,000 + 400,000 + 70,000 + 500 + 2*

Complete DAILY REVIEW b on page 402.

6. Explain that another way to estimate is called *front-end estimation*. As the name implies, you add the values in the greatest place. Closer estimates can be made by adding the values in the first two greatest places.

3,874	4,075	2,167
1 529	1 3,786	1 4,950
4,403	*7,861*	*7,438*
(3,000; 4,300)	*(7,000; 7,700)*	*(6,000; 7,300)*

Add large numbers

For a circus at the city arena, 9,345 tickets were sold for the Friday performance and 23,560 tickets were sold for the two performances on Saturday. What was the total number of tickets sold for Friday and Saturday? *32,905 tickets*

➤ **What equation can you write to solve this word problem?** *9,345 1 23,560 5 t or 23,560 1 9,345 5 t*

1. Write both equations for display.

➤ **Rounding to the place of greatest value, approximately how many tickets were sold? How do you know?** *29,000; 9,000 1 20,000 5 29,000*

➤ **Rounding to the nearest one thousand, approximately how many tickets were sold? How do you know?** *33,000; 9,000 1 24,000 5 33,000*

2. Write the problem vertically. Review renaming as you demonstrate solving the problem. *32,905 tickets*

➤ **Why can you use an estimate to check an answer?** *The estimate helps you to determine whether the answer is reasonable or makes sense.*

➤ **Is 32,905 tickets a reasonable answer? Why?** *Elicit that the sum is reasonable because it is within a few thousand of the estimate and even closer to the adjusted estimate.*

3. Remind the students that addition and subtraction are *inverse operations*. Elicit that addition is the mathematical process of combining parts to make a total, or whole, and subtraction is the mathematical process of separating the total into parts.

➤ **What 2 subtraction equations can you write using the same 3 numbers in the addition problem?** *32,905 2 9,345 5 23,560 and 32,905 2 23,560 5 9,345*

4. Write these problems for display. Direct the students to solve the problems on paper.

3,271,208	203,531,047	45,703
1 704,685	1 16,275,873	1 12,478
3,975,893	*219,806,920*	*789,830*

Student Text pp. 6–7

(***Note***: *Assessment* available on Teacher's Toolkit CD.)

Lesson 3

Student Text pp. 8–9
Daily Review p. 403c

Objectives
- Apply the Zero Principle of Subtraction
- Subtract whole numbers
- Estimate the difference by rounding or using front-end estimation
- Solve subtraction word problems
- Check a subtraction problem, using addition

Teacher Materials
- Place Value Kit
- Money Kit

Student Materials
- Money Kit (optional)

Note
The Zero Principle of Subtraction is not referred to as the Identity Property of Subtraction because the Commutative Property does not apply to subtraction; i.e., $a - 0 = a$, but $0 - a \neq a$.

Teach for Understanding

Apply the Zero Principle of Subtraction

1. Write *minuend* − *subtrahend* = *difference* for display. Explain that the first number in a subtraction equation is called the *minuend* (the number from which another number is subtracted), the second number is called the *subtrahend* (the number that is subtracted from another number), and the answer is called the *difference*.
2. Write $a - 0 = a$ below *minuend* − *subtrahend* = *difference*. Ask students to provide numbers to substitute for the variable, *a*. Rewrite the equation, substituting the given numbers for *a*. (e.g., 3 − 0 = 3)

➤ **Do you think that the minuend could be a fraction or a decimal? Why?** ***Yes; any number minus zero is that number.*** Point out that this principle is called the Zero Principle of Subtraction. Choose students to give equations with minuends that are decimals or fractions. ***possible answers:*** $\frac{3}{4} - 0 = \frac{3}{4}$***;*** $1.3 - 0 = 1.3$

Estimate the difference; subtract 4-digit numbers

The distance between Chicago and Los Angeles is about 2,077 miles. The distance between Chicago and Miami is about 1,316 miles. How much closer is Chicago to Miami than Chicago to Los Angeles? ***761 miles***

➤ **What equation can you write to solve this word problem?** ***2,077 − 1,316 = ___***

1. Write 2,077 − 1,316 = *m* for display. Elicit that the *m* represents the unknown number of miles.

➤ **How can you find an approximate answer?** ***estimate***
➤ **How would you estimate the difference?** ***Round the minuend and the subtrahend to the place of greatest value (nearest one thousand).***
➤ **Approximately how much closer is Chicago to Miami than Chicago to Los Angeles? How do you know?** ***1,000 miles; elicit that 2,077 rounds down to 2,000 and 1,316 rounds down to 1,000, resulting in an estimated difference of 1,000.***

2. Write 2,077 − 1,316 in vertical form. Display the minuend using the ones, tens, hundreds, and one thousands in the Place Value Kit. Choose a student to subtract the ones. Discuss the reason for renaming and whether you need to rename to subtract the ones in this problem.
3. Follow a similar procedure to subtract the remaining places.

➤ **How much closer is Chicago to Miami than Chicago to Los Angeles?** ***761 miles*** Complete the equation.

4. Write these problems for display. Direct the students to estimate the differences before solving the problems on paper.

3,216	4,000	2,608
− 948	− 1,572	− 2,378
2,268	***2,428***	***230***
(2,100)	***(2,000)***	***(1,000)***

➤ **Can an estimate help you check the accuracy of an answer? Why?** ***Yes; elicit that an estimate is only an approximate answer, but it can help you determine whether your answer makes sense or is accurate.***
➤ **Why might you want to find a closer estimate for the last problem?** ***Elicit that the exact answer does not seem reasonable when compared to the estimate.*** **How can you find a closer estimate?** ***Round the numbers to the nearest hundred or use front-end estimation with the 2 greatest places for each number.***

5. Direct some students to round to the nearest hundred to estimate the last problem and other students to use front-end estimation. ***2,600 − 2,400 = 200; 2,600 − 2,300 = 300***

➤ **Does the answer 230 seem more reasonable when compared to an estimate of 200 or 300?** ***yes***

Subtract large numbers; add to check the difference

The average distance between the sun and Mercury is 57,900,000 km. The average distance between the sun and Earth is 149,600,000 km. How much farther is the sun from Earth than the sun from Mercury? ***91,700,000 km***

➤ **What equation can you write to solve this word problem?** ***149,600,000 − 57,900,000 = k***

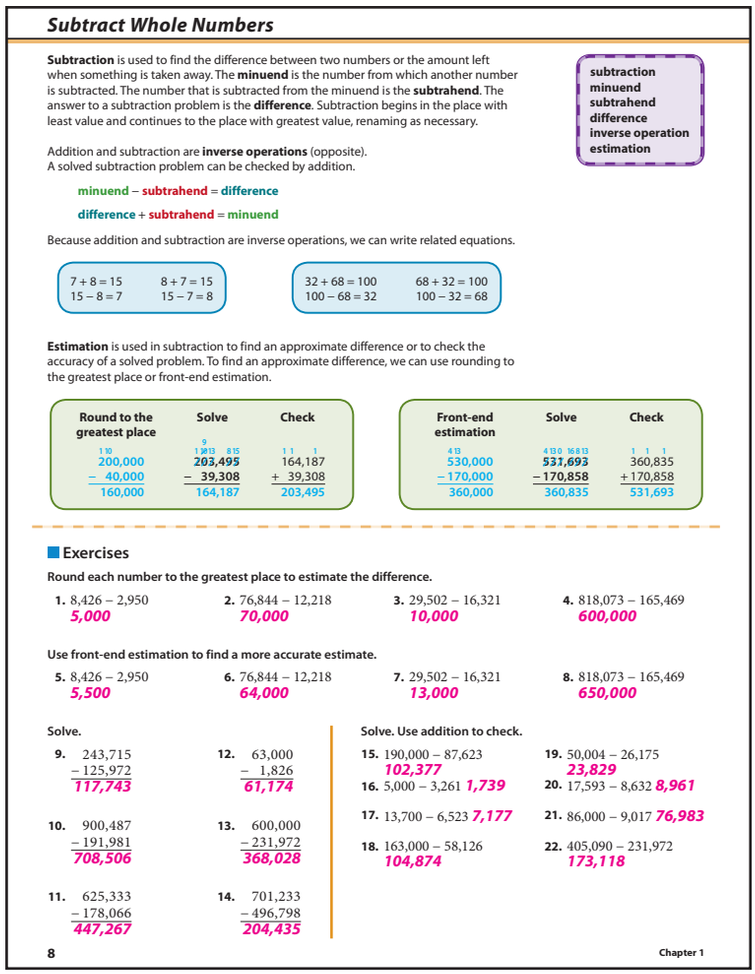
1. Write 149,600,000 − 57,900,000 = *k*. Elicit that the *k* represents the unknown number of kilometers.

➤ **How could you estimate the difference?** ***Round each number to its greatest place: 100,000,000 − 60,000,000 = 40,000,000.***
➤ **Approximately how much farther is the sun from Earth than the sun from Mercury?** ***40,000,000 km***

2. Write the equation vertically. Review renaming as you demonstrate solving the problem. ***91,700,000 km***

➤ **Is 91,700,000 km a reasonable answer? Why?** ***Answers will vary.*** **How could you find a closer or more accurate estimate to know whether your exact answer is reasonable?** ***Elicit that since the minuend is hundred millions and the subtrahend is ten millions, you could round both numbers to the nearest ten million (150,000,000 and 60,000,000).***
➤ **Which is the closer estimate?** ***90,000,000***
➤ **Based on this closer estimate, do you think 91,700,000 km is a reasonable answer?** ***yes***
➤ **What operation is the inverse of subtraction? Why?** ***Addition; addition joins parts to make a whole, and subtraction separates a whole into parts.***
➤ **How can you check your answer?** ***Add the subtrahend (part) and the difference (part) to see if you get the minuend (whole).***

3. Choose a student to demonstrate checking the problem. ***91,700,000 + 57,900,000 = 149,600,000***



Subtract Whole Numbers

Subtraction is used to find the difference between two numbers or the amount left when something is taken away. The **minuend** is the number from which another number is subtracted. The number that is subtracted from the minuend is the **subtrahend**. The answer to a subtraction problem is the **difference**. Subtraction begins in the place with least value and continues to the place with greatest value, renaming as necessary.

subtraction
minuend
subtrahend
difference
inverse operation
estimation

Addition and subtraction are **inverse operations** (opposite).
A solved subtraction problem can be checked by addition.

minuend – **subtrahend** = **difference**

difference + **subtrahend** = **minuend**

Because addition and subtraction are inverse operations, we can write related equations.

7 + 8 = 15 | 8 + 7 = 15
15 – 8 = 7 | 15 – 7 = 8

32 + 68 = 100 | 68 + 32 = 100
100 – 68 = 32 | 100 – 32 = 68

Estimation is used in subtraction to find an approximate difference or to check the accuracy of a solved problem. To find an approximate difference, we can use rounding to the greatest place or front-end estimation.

Round to the greatest place	Solve	Check
200,000	203,495	164,187
– 40,000	– 39,308	+ 39,308
160,000	164,187	203,495

Front-end estimation	Solve	Check
530,000	531,693	360,835
– 170,000	– 170,858	+ 170,858
360,000	360,835	531,693

Exercises

Round each number to the greatest place to estimate the difference.

1. 8,426 – 2,950 — *5,000*
2. 76,844 – 12,218 — *70,000*
3. 29,502 – 16,321 — *10,000*
4. 818,073 – 165,469 — *600,000*

Use front-end estimation to find a more accurate estimate.

5. 8,426 – 2,950 — *5,500*
6. 76,844 – 12,218 — *64,000*
7. 29,502 – 16,321 — *13,000*
8. 818,073 – 165,469 — *650,000*

Solve.

9. 243,715 – 125,972 = *117,743*
10. 900,487 – 191,981 = *708,506*
11. 625,333 – 178,066 = *447,267*
12. 63,000 – 1,826 = *61,174*
13. 600,000 – 231,972 = *368,028*
14. 701,233 – 496,798 = *204,435*

Solve. Use addition to check.

15. 190,000 – 87,623 = *102,377*
16. 5,000 – 3,261 = *1,739*
17. 13,700 – 6,523 = *7,177*
18. 163,000 – 58,126 = *104,874*
19. 50,004 – 26,175 = *23,829*
20. 17,593 – 8,632 = *8,961*
21. 86,000 – 9,017 = *76,983*
22. 405,090 – 231,972 = *173,118*

8 Chapter 1

Solve. Do the operations in parentheses first.

23. (13 – 3) + 8 = *18*
24. 27 + (2 + 18) = *47*
25. (17 – 7) + 8 = *18*
26. 75 – (41 + 19) = *15*
27. 50 + (19 + 11) = *80*
28. (100 – 40) – 20 = *40*
29. (39 + 11) – 6 = *44*
30. (17 + 13) – 20 = *10*

Solve.

31. One afternoon at Oakview Christian Camp, 80 canoeists were on the lake. Fifty-eight of the canoeists were campers and the rest were counselors. How many of the canoeists were counselors? *80 – 58 = 22 counselors*
32. Before the first activity of the day, campers have 20 minutes for cabin clean-up, 25 minutes for breakfast, and 30 minutes for cabin devotions. Does it take more or less than an hour to complete their morning routine? *20 + 25 + 30 = 75 min; more than an hour*
33. The camp has 108 canoe paddles. A recent inventory determined that some of the paddles had to be repaired. If only 88 paddles remained at camp, how many paddles were sent to be repaired? *108 – 88 = 20 paddles*
34. Alana and Andrea each wrote a report about the week at camp. Alana's report was 671 words long. Andrea's report was 1,159 words long. How much longer was Andrea's report? *1,159 – 671 = 488 words*

Practice & Application

35. Write equations for the fact family using 3, 9, and 12. *3 + 9 = 12; 9 + 3 = 12; 12 – 9 = 3; 12 – 3 = 9. Order may vary.*
36. Find the sum of 67 and 15. Write another addition equation and two subtraction equations using the same numbers. *67 + 15 = 82; 15 + 67 = 82; 82 – 15 = 67; 82 – 67 = 15*
37. Write three facts with a sum of 10 using different addends for each fact. *Answers may vary. 2 + 8 = 10; 3 + 7 = 10; 4 + 6 = 10*
38. Write the largest four-digit whole number. *9,999*
39. Write the number that is 1,000 *less than* 150,390. *149,390*
40. Write the sum of 17,398 and 209,343. *226,741*
41. Write the value of 6 in 1,631,700 in standard form and word form. *600,000; six hundred thousand*
42. Which two *hundred thousands* is 108,964 between? *100,000 and 200,000*
43. Estimate the difference of 413,982 and 192,116 by using front-end estimation. *410,000 – 190,000 = 220,000*
44. Write the next nine numbers for the *count by 7* pattern: 7, 14, 21. *28, 35, 42, 49, 56, 63, 70, 77, 84*
45. Use the clues to write the number.
    - 6 in the Hundred Thousands and Tens places
    - 4 in the Millions place
    - 9 in the Ten Thousands place
    - No other place has a digit with value

    4,690,060

Use the part-whole model to answer problems 46–47.

whole	
part	part

179,357,065	
179,356,000	*n*

46. Evaluate the whole and the part. Name the places with different values. *one thousands, tens, and ones*
47. Write an equation to find the unknown part. Solve. *179,357,065 – 179,356,000 = n; n = 1,065*

48. Draw a part-whole model to show the solution for problem 34.

J **Journal Entry:** Explain why rounding the addends 3,884,298; 117,351; and 281,496 to the nearest ten thousand gives an estimate closer to the actual sum than rounding to the greatest place. *More of the digits/places in each number are added.*

48.

1,159	
671	*488*

Complete DAILY REVIEW C on page 403.

Lesson 3 9

(*Note:* You could show the students how to add the difference and the subtrahend *mentally* rather than writing the addition problem.)

4. Write these problems for display. Direct the students to check each problem after solving it on paper.

23,046,308	700,500,600	803,471
– 4,704,659	– 246,340,705	– 52,475
18,341,649	*454,159,895*	*750,996*

Solve subtraction word problems

➤ **When is addition used to solve a word problem?** ***Elicit when joining sets to find the total number (whole).***

➤ **When is subtraction used to solve a word problem?** ***Possible answers: when finding the difference; when removing part of a set; when finding how many are needed.***

1. Explain that subtraction is used in many different situations. Discuss the subtraction situations on page 471 of the Handbook in the Student Text.
2. Use the Money Kit to demonstrate each type of subtraction in the following word problems. Direct the students to illustrate the problems by drawing pictures or using their Money Kits. Discuss the action in each situation and identify the type of subtraction.
3. Choose students to compose other word problems for each type of subtraction, using larger numbers.

Mark has 8 dollars. He needs 12 dollars to purchase a ticket for a ball game. How much more money does Mark need to purchase a ticket? ***8 + n = 12; 12 – 8 = 4 dollars; Missing Addend***

Barry had 12 dollars to spend at a ball game. After the game, he had 8 dollars. How much money did Barry spend at the ball game? ***12 – n = 8; 12 – 8 = 4 dollars; Missing Subtrahend***

Ariana had 12 dollars. She spent 8 dollars. How much money does Ariana have left? ***12 – 8 = 4 dollars; Take-Away***

Kelly has 12 dollars, and Carol has 8 dollars. How much more money does Kelly have than Carol? ***12 – 8 = 4 dollars; Comparing***

Trey has one-dollar bills and five-dollar bills in his wallet. He has 12 bills in his wallet. Since he has 8 one-dollar bills, how many five-dollar bills does he have? ***12 – 8 = 4 five-dollar bills; Unknown Part***

Student Text pp. 8–9

(***Note***: *Assessment* available on Teacher's Toolkit CD.)

Lesson 4

Student Text pp. 10–11
Daily Review p. 403d

Objectives
- Demonstrate an understanding of decimal place value
- Express decimals in standard form, word form, fraction form, expanded form, and expanded form with multiplication
- Identify the value of the digits in a number
- Compare and order decimals
- Round decimals to the place of greatest value or to a given place

Teacher Materials
- Place Value Kit
- Decimal Place Value Pocket Chart Kit
- Decimal Number Lines, page IA1 (CD)

Student Materials
- Decimal Place Value Pocket Chart Kit

Note
In this lesson, the red side (the back) of the hundreds will be referred to as the ones, the orange side of the tens as the tenths, and the purple side of the ones as the hundredths.

Teach for Understanding

Demonstrate an understanding of decimal place value

1. Display the Decimal Place Value Pocket Chart (B) and distribute the Decimal Place Value Pocket Chart Kits. Explain that the Ones place is the center of our number system. The *decimal point* marks the Ones place; it separates the whole numbers from the decimal fractions. Our number system has an infinite number of places on each side of the Ones place.
2. Display the number 2.48 in your pocket chart. Draw a place value frame for display; label the Ones, Tenths, and Hundredths places. Display 2 large red ones, 4 orange tenths, and 8 purple hundredths in the frame. Remind the students that the decimal point is read *and*. Choose a volunteer to read the number aloud. ***two and forty-eight hundredths***
3. Direct the students to display in their pocket charts the number that is 1 tenth more than 2.48. ***2.58*** Add 1 tenth to the place value frame. Remove the 4 from the pocket chart and put a 5 in the Tenths place.
   - **What number is 1 hundredth more than 2.58?** ***2.59***
     1 hundredth more than 2.59? ***2.60 or 2.6***
   - **What did you do with the 10 hundredths?** ***renamed the 10 hundredths as 1 tenth*** Review renaming if needed.
4. Follow a similar procedure for several other numbers.
5. Remind the students that because our number system is a base ten system, each place has a value that is 10 times greater than the place to its right and $\frac{1}{10}$ of the value of the place to its left.
   - **What 3 decimal places are to the right of the Hundredths place?** ***One Thousandths place, Ten Thousandths place, and Hundred Thousandths place*** Explain that the One Thousandths place is often referred to as the *Thousandths place*.
6. Instruct the students to display these decimals in their pocket charts as you read them aloud. Remind them that a zero is written in the Ones place when there are no whole numbers in the decimal and that the zero is not read.
   4.076 0.315 0.004 2.608
7. Write these decimals for display and guide the students in reading them aloud. Remind the students to say the place value of the last digit after reading the last digit.
   3.6015 2.089 0.00475 7.00350

Express decimals in different forms

1. Direct attention to the chart showing the number forms on Student Text page 10. Explain that decimals can be written in different forms, similar to whole numbers. The standard form is the most common form. When writing the word form, the decimal point is indicated by writing the word *and*.
2. Write 5.0307 for display and choose a student to read the number aloud. Direct the students to write the word form of the number on paper. ***five and three hundred seven ten thousandths***
3. Explain that decimals can also be written in *fraction form*; 5.0307 is written as a mixed number.
   - **What is the whole number in 5.0307?** ***5***
   - **What is the fraction in 5.0307?** $\frac{307}{10,000}$ Point out that the number of zeros in the denominator of the mixed number matches the number of places in the decimal.

   Direct the students to write the mixed number on paper. ***5*** $\frac{307}{10,000}$
4. Remind the students that *expanded form* shows the value of each digit. Direct the students to write 5.0307 in expanded form. (***Note:*** Zero may be written as a placeholder.) ***5 + 0.03 + 0.0007*** Point out that the number of addends (zeros omitted) matches the number of nonzero digits in the decimal.
5. Remind the students that when you write a number in *expanded form with multiplication*, the value of each place is multiplied by the corresponding digit.

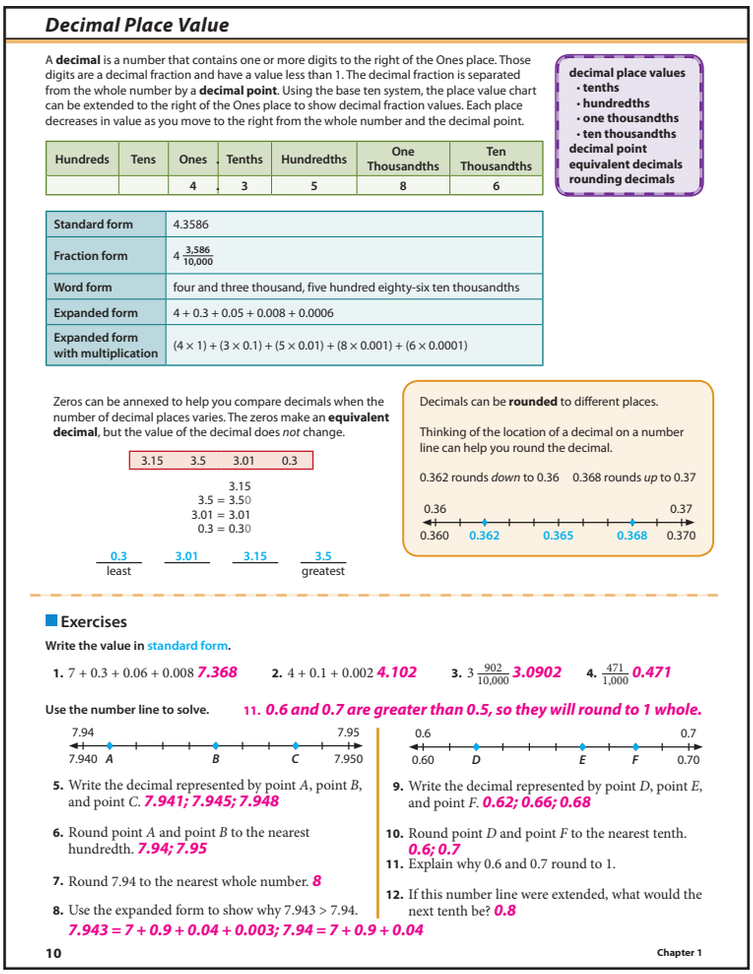
   Direct the students to write 5.0307 in expanded form with multiplication. ***(5 × 1) + (3 × 0.01) + (7 × 0.0001)***
6. Write these numbers for display. Instruct the student to write them in the other four forms.
   5.003 0.0078 3.00062

Compare and order decimals

- **How can you compare whole numbers?** ***Elicit that if the whole numbers have a different number of digits, the number with more digits is greater. If the whole numbers have the same number of digits, begin with the place of greatest value and compare the digits in each place until the digits in a place have different values; the digit with the greater value indicates the greater number.***

1. Write 0.268 __ 0.26 for display.
   - **How can you compare decimals when the whole numbers are the same?** ***Elicit that you compare the digits to the right of the decimal point; begin with the place of greatest value (Tenths) and compare the digits in each place until the digits in a place have different values; the digit with the greater value indicates the greater number.***
   - **How can annexing zeros help you to compare decimals?** ***You can annex zeros to decimals so that the decimals have the same number of decimal places. Then compare the digits in each place.***

   Select a student to complete the number sentence using >, <, or =. ***0.268 > 0.260***
2. Guide the students in comparing these decimals.
   4.040 = 4.04 0.4281 < 0.51 0.967 > 0.01000
   6 + 0.03 + 0.0004 < (6 × 1) + (3 × 0.1) + (4 × 0.01)
   five and forty-three hundredths > $5\frac{43}{1000}$



Decimal Place Value

A **decimal** is a number that contains one or more digits to the right of the Ones place. Those digits are a decimal fraction and have a value less than 1. The decimal fraction is separated from the whole number by a **decimal point**. Using the base ten system, the place value chart can be extended to the right of the Ones place to show decimal fraction values. Each place decreases in value as you move to the right from the whole number and the decimal point.

decimal place values
- tenths
- hundredths
- one thousandths
- ten thousandths

decimal point
equivalent decimals
rounding decimals

Hundreds	Tens	Ones	.	Tenths	Hundredths	One Thousandths	Ten Thousandths
		4	.	3	5	8	6

Standard form	4.3586
Fraction form	$4\frac{3,586}{10,000}$
Word form	four and three thousand, five hundred eighty-six ten thousandths
Expanded form	4 + 0.3 + 0.05 + 0.008 + 0.0006
Expanded form with multiplication	(4 × 1) + (3 × 0.1) + (5 × 0.01) + (8 × 0.001) + (6 × 0.0001)

Zeros can be annexed to help you compare decimals when the number of decimal places varies. The zeros make an **equivalent decimal**, but the value of the decimal does *not* change.

3.15 3.5 3.01 0.3

3.15
3.5 = 3.50
3.01 = 3.01
0.3 = 0.30

0.3 (least) 3.01 3.15 3.5 (greatest)

Decimals can be **rounded** to different places.

Thinking of the location of a decimal on a number line can help you round the decimal.

0.362 rounds *down* to 0.36 0.368 rounds *up* to 0.37

0.36 0.37
0.360 0.362 0.365 0.368 0.370

Exercises

Write the value in standard form.

1. 7 + 0.3 + 0.06 + 0.008 ***7.368***
2. 4 + 0.1 + 0.002 ***4.102***
3. $3\frac{902}{10,000}$ ***3.0902***
4. $\frac{471}{1,000}$ ***0.471***

Use the number line to solve.

7.94 A B C 7.95 (7.940 … 7.950)

5. Write the decimal represented by point *A*, point *B*, and point *C*. ***7.941; 7.945; 7.948***
6. Round point *A* and point *B* to the nearest hundredth. ***7.94; 7.95***
7. Round 7.94 to the nearest whole number. ***8***
8. Use the expanded form to show why 7.943 > 7.94. ***7.943 = 7 + 0.9 + 0.04 + 0.003; 7.94 = 7 + 0.9 + 0.04***

0.6 D E F 0.7 (0.60 … 0.70)

9. Write the decimal represented by point *D*, point *E*, and point *F*. ***0.62; 0.66; 0.68***
10. Round point *D* and point *F* to the nearest tenth. ***0.6; 0.7***
11. Explain why 0.6 and 0.7 round to 1. ***0.6 and 0.7 are greater than 0.5, so they will round to 1 whole.***
12. If this number line were extended, what would the next tenth be? ***0.8***

10 Chapter 1

Write the value of 5 in the number.

13. 29.0502 ***0.0500*** 14. 4.3256 ***0.0050*** 15. 51.987 ***50*** 16. 43.506 ***0.500*** 17. 3.9875 ***0.0005***

Write a comparison sentence using >, <, or =.

18. 0.5 < 0.55
19. 0.63 > 0.603
20. 0.8 < 0.888
21. 2.606 < 2.66
22. 0.18 < 0.2
23. 0.1 > 0.05
24. 4.04 < four and four tenths
25. 0.009 = nine thousandths
26. seven hundredths > eleven thousandths

Write the numbers from *least* to *greatest*.

27. 0.4079 0.7 0.479 0.4793
0.4079 0.479 0.4793 0.7

28. 5.682 5.421 5.6 4.986
4.986 5.421 5.6 5.682

Solve.

29. 13,942 + 71,806 + 42,999 = ***128,747***
30. 1,398,420 + 625,916 + 21,387 = ***2,045,723***
31. 16,000 − 4,579 = ***11,421***
32. 802,000 − 29,876 = ***772,124***

Practice & Application

33. Write the next six numbers in the *count by 8* pattern: 8, 16, 24, 32. ***40, 48, 56, 64, 72, 80***
34. Use front-end estimation to estimate the sum of 47,607 and 21,049. ***47,000 + 21,000 = 68,000***
35. Round to the nearest one thousand to estimate the difference of 58,577 and 21,049. ***59,000 − 21,000 = 38,000***
36. Round 573.073 to the nearest whole number. ***573***
37. Round 573.073 to the greatest place. ***600***
38. Which two *hundred thousands* is 391,360 between? ***300,000 and 400,000***
39. Write the number that is 1,000 *less than* 290,384. ***289,384***

Journal Entry: Draw a part-whole model for 7,983 + *n* = 10,500. Explain how subtraction can help you solve this problem.

PATTERNS IN MATH

Fibonacci, an Italian mathematician, devised a list of numbers now called *Fibonacci numbers*. The first few numbers in this sequence are 1, 1, 2, 3, 5, 8, 13, 21, and 34. Notice that each number is the sum of the two numbers before it. What are the next four Fibonacci numbers? ***55, 89, 144, 233***

The spirals of a sunflower are formed by the individual florets in such a way that there are 21 spirals clockwise and 34 spirals counterclockwise. Notice that 21 and 34 are next to each other in the Fibonacci sequence. A similar arrangement of spirals is found in pinecone scales. As we notice the Fibonacci sequence in nature, we are reminded that there is more to the world than what we can see. There must be a very smart, very powerful Person behind it all—designing everything and holding it all together. The Bible tells us who this Person is. What does Psalm 145 say about who this Person is and what He is like?

Complete DAILY REVIEW 4 on page 403.

Lesson 4 11

3. Direct each student to write 4 decimals on paper and then direct him to rewrite the 4 decimals in order from least to greatest. Instruct the students to exchange papers and check the order.

Round decimals

1. Display the first number line on the Decimal Number Lines page.
   - ➤ **What number does this number line start with? *0* end with? *2***
   - ➤ **How is the number line partitioned between 0 and 1? *tenths* between 1 and 2? *tenths***

   Choose a student to plot (i.e., draw a dot to identify) 1.3 on the number line and label it point *A*.
   - ➤ **Which whole number is 1.3 closer to? *1***
   - ➤ **Should 1.3 be rounded down or up? Why? *Down; you round down when the digit to the right of the rounding place is less than 5.***
   - ➤ **How is this number line partitioned between 0 and 0.1? *hundredths***

   Select a student to plot 0.57 on the number line and label it point *B*.
   - ➤ **What whole number does 0.57 round to? Why? *1; the Tenths place is to the right of the rounding place (the Ones place). Since 5 is in the Tenths place, round up to the next whole number.***
   - ➤ **What tenth does 0.57 round to? *0.6*** Point out that when you round decimals, it is not necessary to write zeros to the right of the rounding place.
2. Display the second number line.
   - ➤ **What number does this number line start with? *0* end with? *0.2***
   - ➤ **How is this number line partitioned between 0 and 0.1? *hundredths* between 0.01 and 0.02? *thousandths***

   Choose a student to plot 0.146 on the number line and label it point *C*.
   - ➤ **What tenth does 0.146 round to? *0.1* hundredth? *0.15***
3. Display the third number line.
   - ➤ **What number does this number line start with? *0* end with? *0.02***
   - ➤ **How is this number line partitioned between 0 and 0.01? *thousandths* between 0.001 and 0.002? *ten thousandths***

   Select a student to plot 0.0178 on the number line and label it point *D*.
   - ➤ **What hundredth does 0.0178 round to? *0.02* thousandth? *0.018***
4. Guide the students in plotting other points on the number lines and rounding the decimals.

Student Text pp. 10–11

Answers and procedures that do not appear in the answer overprint on the reduced Student Text pages in each lesson are provided in the Solutions section on pages 399–423 of this Teacher's Edition and on the Teacher's Toolkit CD.

Lesson 5

Student Text pp. 12–13
Daily Review p. 404e

Objectives
- Apply addition properties to decimals: Commutative Property, Identity Property, and Associative Property
- Add and subtract decimals
- Estimate sums and differences
- Check a subtraction problem, using addition

Teacher Materials
- Place Value Kit

Teach for Understanding

Apply addition properties to decimals

1. Write 3 + 8 = 8 + 3 for display.
➤ **Is this equation true or false? Why?** ***True; 3 + 8 = 11 and 8 + 3 = 11.***
➤ **Is it necessary to add the addends to know that the equation is true? Why?** ***No, the same addends are in each expression and the order of the addends does not affect the sum.***
➤ **What addition property proves that the order of the addends can be changed without changing the sum?** ***Commutative Property of Addition***
2. Write 7 + 0 = 7 for display.
➤ **What do you know about the sum when one of the addends is zero?** ***The sum is equal to the value of the other addend(s).***
➤ **What addition property proves that when zero is added to a number, the sum is that number?** ***Identity Property of Addition***
3. Write (6 + 9) + 1 = 6 + (9 + 1) for display.
➤ **What do parentheses in an equation tell you?** ***Complete the operation in the parentheses first.***
➤ **What addition property proves that you can group addends differently without changing the sum?** ***Associative Property of Addition***
Choose a student to demonstrate solving each side of the equation. ***15 + 1 = 6 + 10; 16 = 16***
➤ **Why might you want to change the grouping of the addends in this problem?** ***Answers may vary, but elicit that making a ten makes adding mentally easier.***
➤ **When using addition properties, must the addends be 1-digit whole numbers? Why?** ***No; the properties are true for any type of addends (e.g., multiple digits, decimals, fractions).***
4. Write the following statements for display. Choose students to use mental math to complete the statements using an equal sign or a not-equal sign. Direct them to tell the properties and/or strategies they used.
35 + 796 $\underline{=}$ 796 + 35
219.03 + 0 $\underline{\neq}$ 213.09
4 + (79.2 + 3.8) $\underline{\neq}$ (4 + 79.2) + 3.9
2,450,613 + 73 $\underline{\neq}$ 79 + 2,450,613
34 + 25 + 76 $\underline{=}$ 34 + 76 + 25
5. Write these equations. Select students to identify the missing addend and to tell what 2 properties helped them determine the addend.
(68 + 75) + __ = (68 + 2) + 75 ***2; Commutative and Associative Properties of Addition***
765 + (1.3 + 0) = (765 + 1.3) + __ ***0; Associative and Identity Properties of Addition***
6. Guide the students in writing the following equations. Choose students to substitute decimals for the variables and to solve the equations.
➤ **Using the variable *a*, what equation could you write for the Identity Property of Addition?** **a + *0* = a**
➤ **Using variables *a* and *b* as the addends, what equation could you write for the Commutative Property of Addition?** **a + b = b + a**
➤ **Using variables *a*, *b*, and *c*, what equation could you write for the Associative Property of Addition?** **(a + b) + c = a + (b + c)**

Add decimals

While on vacation, Eric went cross-country skiing on three different trails. The first trail took 1.75 hours to complete, the second trail took 2.4 hours, and the last trail took 3.8 hours. How much time did Eric spend skiing on these trails? ***7.95 hours***

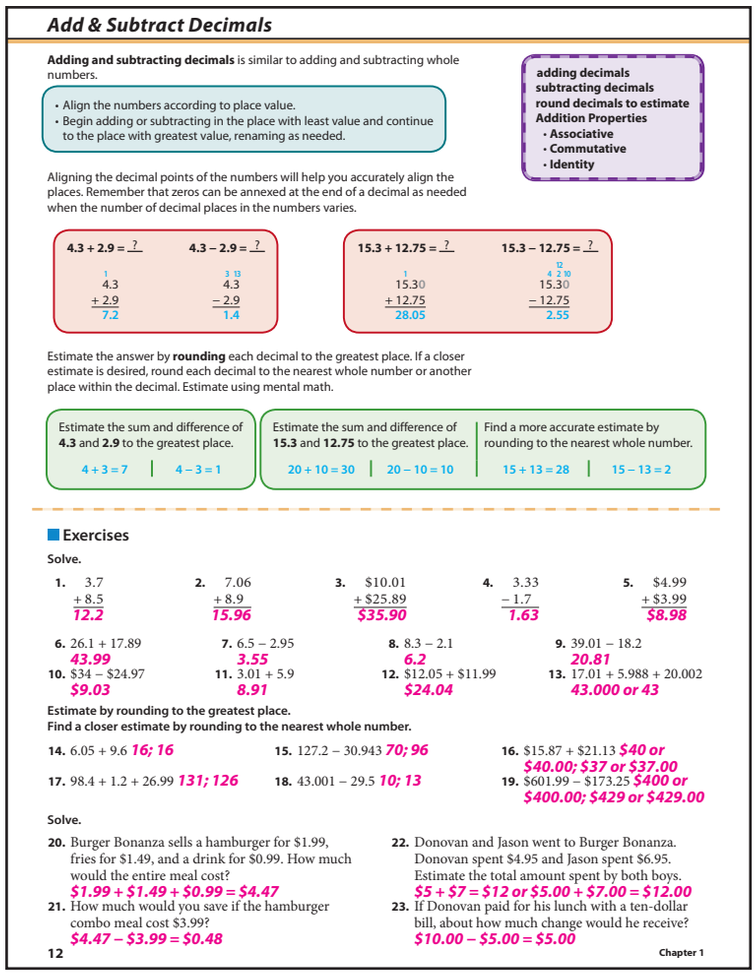
➤ **How can you find Eric's total time?** ***Add the 3 individual times together.***
➤ **How could you estimate Eric's time to the nearest hour?** ***Round each addend to the nearest whole hour (Ones place) and then add.***
➤ **What is the estimated time in hours? How do you know?** ***8 hours; elicit that 1.75 rounds up to 2, 2.4 rounds down to 2, and 3.8 rounds up to 4, resulting in an estimated sum of 8.***

1. Direct the students to write the addition problem vertically, aligning the decimal points and annexing zeros if needed. Point out the alignment of the Ones, Tenths, and Hundredths places.
2. Display the addends using ones, tenths, and hundredths from the Place Value Kit. (***Note:*** You may choose to place the manipulatives in a place value frame drawn for display.) Choose one student to demonstrate combining the hundredths as another student adds the hundredths in the problem.
5 hundredths
Repeat the procedure for adding each place. Discuss the need to rename 10 of any unit as 1 of the next greater unit.
7.95 hours
Compare the exact answer to the estimated answer.
3. Guide the students in writing these equations vertically on paper. Direct them to estimate the sums to the nearest whole before solving the problems.
5.12 + 3.746 = ***8.866 (9)***
42.564 + 8.7 = ***51.264 (52)***
0.3469 + 0.56 = ***0.9069 (1)***

Subtract decimals; add to check the difference

At a winter sports event, Eric watched skaters racing. During one race, the winner finished in 5.74 minutes, and the second-place skater finished in 6.3 minutes. How much faster was the winner of the race than the skater who finished second? ***0.56 of a minute***

➤ **How can you find the difference between the times of the two skaters?** ***Subtract the shorter time from the longer time.***
➤ **How could you estimate the difference between the two times?** ***Round the minuend and the subtrahend to the nearest minute (Ones place) and then subtract.***



Add & Subtract Decimals

Adding and subtracting decimals is similar to adding and subtracting whole numbers.

- Align the numbers according to place value.
- Begin adding or subtracting in the place with least value and continue to the place with greatest value, renaming as needed.

adding decimals
subtracting decimals
round decimals to estimate
Addition Properties
- **Associative**
- **Commutative**
- **Identity**

Aligning the decimal points of the numbers will help you accurately align the places. Remember that zeros can be annexed at the end of a decimal as needed when the number of decimal places in the numbers varies.

4.3 + 2.9 = ?

$$\begin{array}{r} {\scriptstyle 1} \\ 4.3 \\ +\ 2.9 \\ \hline 7.2 \end{array}$$

4.3 − 2.9 = ?

$$\begin{array}{r} {\scriptstyle 3\ 13} \\ 4.3 \\ -\ 2.9 \\ \hline 1.4 \end{array}$$

15.3 + 12.75 = ?

$$\begin{array}{r} {\scriptstyle 1} \\ 15.30 \\ +\ 12.75 \\ \hline 28.05 \end{array}$$

15.3 − 12.75 = ?

$$\begin{array}{r} {\scriptstyle 12} \\ {\scriptstyle 4\ 2\ 10} \\ 15.30 \\ -\ 12.75 \\ \hline 2.55 \end{array}$$

Estimate the answer by **rounding** each decimal to the greatest place. If a closer estimate is desired, round each decimal to the nearest whole number or another place within the decimal. Estimate using mental math.

Estimate the sum and difference of **4.3** and **2.9** to the greatest place.
4 + 3 = 7 | 4 − 3 = 1

Estimate the sum and difference of **15.3** and **12.75** to the greatest place.
20 + 10 = 30 | 20 − 10 = 10

Find a more accurate estimate by rounding to the nearest whole number.
15 + 13 = 28 | 15 − 13 = 2

Exercises

Solve.

1. $\begin{array}{r} 3.7 \\ +\ 8.5 \\ \hline 12.2 \end{array}$
2. $\begin{array}{r} 7.06 \\ +\ 8.9 \\ \hline 15.96 \end{array}$
3. $\begin{array}{r} \$10.01 \\ +\ \$25.89 \\ \hline \$35.90 \end{array}$
4. $\begin{array}{r} 3.33 \\ -\ 1.7 \\ \hline 1.63 \end{array}$
5. $\begin{array}{r} \$4.99 \\ +\ \$3.99 \\ \hline \$8.98 \end{array}$
6. 26.1 + 17.89 *43.99*
7. 6.5 − 2.95 *3.55*
8. 8.3 − 2.1 *6.2*
9. 39.01 − 18.2 *20.81*
10. $34 − $24.97 *$9.03*
11. 3.01 + 5.9 *8.91*
12. $12.05 + $11.99 *$24.04*
13. 17.01 + 5.988 + 20.002 *43.000 or 43*

Estimate by rounding to the greatest place.
Find a closer estimate by rounding to the nearest whole number.

14. 6.05 + 9.6 *16; 16*
15. 127.2 − 30.943 *70; 96*
16. $15.87 + $21.13 *$40 or $40.00; $37 or $37.00*
17. 98.4 + 1.2 + 26.99 *131; 126*
18. 43.001 − 29.5 *10; 13*
19. $601.99 − $173.25 *$400 or $400.00; $429 or $429.00*

Solve.

20. Burger Bonanza sells a hamburger for $1.99, fries for $1.49, and a drink for $0.99. How much would the entire meal cost? *$1.99 + $1.49 + $0.99 = $4.47*
21. How much would you save if the hamburger combo meal cost $3.99? *$4.47 − $3.99 = $0.48*
22. Donovan and Jason went to Burger Bonanza. Donovan spent $4.95 and Jason spent $6.95. Estimate the total amount spent by both boys. *$5 + $7 = $12 or $5.00 + $7.00 = $12.00*
23. If Donovan paid for his lunch with a ten-dollar bill, about how much change would he receive? *$10.00 − $5.00 = $5.00*

The **Addition Properties** are rules for all addition equations. Applying these rules when adding helps you to solve the problem using mental math or makes the computation quicker.

Commutative Property
The order of addends can be changed without changing the sum.
4 + 9 = 9 + 4
a + *b* = *b* + *a*
Thinking of 9 + 4 allows me to mentally *count on* the smaller number to find the sum of 13.

Associative Property
The grouping of addends can be changed without changing the sum.
(25 + 33) + 17 = 25 + (33 + 17)
(*a* + *b*) + *c* = *a* + (*b* + *c*)
Grouping the 33 and 17 allows me to mentally make 10 in the Ones place.
25 + 50 = 75

Identity Property
When 0 is added to an addend, the sum is the other addend.
37 + 0 = 37
a + 0 = *a*
Nothing is added to 37.

Exercises

Use the Associative Property to regroup the addends to make the addition quicker. Solve.

24. (5 + 6) + (4 + 7) + 3 *5 + (6 + 4) + (7 + 3) = 25*
25. $3.20 + ($4.80 + $15.65) *($3.20 + $4.80) + $15.65 = $23.65*
26. (16.4 + 12.2) + 10.8 *16.4 + (12.2 + 10.8) = 39.4*

Use the Commutative Property and the Associative Property to group the addends to make the addition quicker. Solve.

27. 23 + 44 + 57 *(23 + 57) + 44 = 124*
28. $5.25 + $9.11 + $14.75 *($5.25 + $14.75) + $9.11 = $29.11*
29. 17 + 12 + 18 + 13 *(17 + 13) + (12 + 18) = 60*
30. 3 + 2.05 + 7.2 *(3 + 7.2) + 2.05 = 12.25*
31. 49 + 38 + 51 *(49 + 51) + 38 = 138*
32. 12.5 + 4.005 + 1.5 *(12.5 + 1.5) + 4.005 = 18.005*

Write an equation and solve.

33. four and ninety-eight hundredths added to seventeen hundredths *0.17 + 4.98 = 5.15*
34. the difference between 3,670 and 973 *3,670 − 973 = 2,697*
35. two and four hundredths less than seven and one tenth *7.1 − 2.04 = 5.06*
36. one thousand more than 13,500 *13,500 + 1,000 = 14,500*

Practice & Application

37. Write 439.1, 439.09, 439.6, and 439.001 from *least* to *greatest*. Find the sum of the numbers. *439.001, 439.09, 439.1, 439.6; 1,756.791*
38. Write the *count by* 9 numbers from 9 to 90. *9, 18, 27, 36, 45, 54, 63, 72, 81, 90*
39. Round 1,389,462 and 732,690 to the nearest ten thousand. *1,390,000; 730,000*
40. Estimate the sum of 6.931, 3.4, and 19.702. *7 + 3 + 20 = 30*
41. Write 28,307,013 in word form and expanded form.
42. Draw a number line. Label the endpoints 7,000 and 8,000. Identify and plot the halfway point.
    7,500 (7,000 — 8,000)
43. Plot 1,790 on a number line with 1,000 and 2,000 as endpoints.
    1,790 (1,000 — 2,000)
44. Use the Commutative Property and the Associative Property to solve the equation. (37 + 46) + 73 = ? *46 + (37 + 73) = 156*
45. Solve the equation 65 + 90 + 35 = ?. Change the order and group the addends to make it easier to solve. *(65 + 35) + 90 = 190*

Journal Entry: Define the terms *sum* and *difference* and give an example of each using 17, 38, and 55. Circle the sum and the difference.

Complete DAILY REVIEW 6 on page 404.

➤ **What is the approximate difference? How do you know?** ***0 minutes; 5.74 rounds up to 6 and 6.3 rounds down to 6, resulting in a difference of 0.***

1. Point out that the estimated difference of 0 minutes does not mean there is no difference between the times, but that the difference will likely be less than 1 whole minute.
2. Direct the students to write the exact subtraction problem vertically, aligning the decimal points. Point out the alignment of the Ones, Tenths, and Hundredths places. Remind the students that they can write a zero in the Hundredths place of 6.3 to help them align the digits and subtract.
3. Display the minuend using ones, tenths, and hundredths from the Place Value Kit. Choose one student to demonstrate subtracting the hundredths as another student subtracts the hundredths in the problem. Discuss the need to rename 1 of any unit as 10 of the next lesser unit (1 tenth = 10 hundredths). ***6 hundredths***

   Repeat the procedure for subtracting each place. ***0.56 of a minute***

   Compare the exact answer to the estimated answer.

   ➤ **Does this answer seem reasonable when compared to the estimate?** ***yes***

   ➤ **What operation is the inverse of subtraction? Why?** ***Addition; accept any reasonable explanation.***

   ➤ **How can you check the difference using addition?** ***Add the subtrahend (part) and the difference (part) to see if you get the minuend (whole).***
4. Choose a student to demonstrate checking the problem. ***0.56 + 5.74 = 6.30***
5. Guide the students in writing these problems vertically on paper. Direct them to estimate the differences to the nearest whole before solving the problems and to check at least one of their answers.

   8.5012 − 3.7 = ***4.8012 (5)*** 38.01 − 5.406 = ***32.604 (33)***

   0.206 − 0.0016 = ***0.2044 (0)***

Student Text pp. 12–13

Lesson 6

Student Text pp. 14–15
Daily Review p. 404f

Objectives
- Demonstrate an understanding of the inverse relationship between addition and subtraction
- Use a part-whole model to solve addition and subtraction word problems
- Write an equation for a word problem
- Solve multi-step word problems

Teacher Materials
- Part-Whole Models, page IA2 (CD)
- Problem-Solving Plan, page IA3 (CD)
- Christian Worldview Shaping, pages 1–3 (CD)

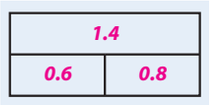
Student Materials
- Christian Worldview Shaping, page 2 (CD)

Note
Just as the order of addends can vary in an equation because of the Commutative and Associative Properties of Addition, the order of the parts in a part-whole model also can vary.

Teach for Understanding

Demonstrate an understanding of the inverse relationship between addition and subtraction

1. Display only the row of models on the top of the Part-Whole Models page. Guide a discussion about the relationship of the parts to the whole in the addition model (addend-addend-sum) and the subtraction model (difference-subtrahend-minuend).
   Display the first row of problems and discuss joining the known parts to find the whole (addition). Next, display the second row of problems to discuss taking a known part from the whole to find the unknown part (subtraction).
   Finally, uncover the equations and discuss the inverse relationship shown in each pair of equations.
2. Write 0.6, 0.8, and 1.4 for display. Direct the students to write the related addition and subtraction equations for the numbers and to draw a part-whole model to show the relationship. Write the equations and draw the model for display.



   0.6 + 0.8 = 1.4 *0.8 + 0.6 = 1.4*
   1.4 − 0.8 = 0.6 *1.4 − 0.6 = 0.8*
   Guide the students in identifying each number in the equations as a part or a whole and the mathematical term for the number [e.g., 0.6 + 0.8 = 1.4; part (addend) + part (addend) = whole (sum)].
3. Guide the students in using a variable (*n*) to write all the possible equations for each missing part and for the missing whole.

0.6 (part)	0.8 (part)	1.4 (whole)
n + *0.8* = *1.4*	*0.6* + n = *1.4*	*****0.6* + *0.8* = n
0.8 + n = *1.4*	n + *0.6* = *1.4*	*****0.8* + *0.6* = n
*****1.4* − *0.8* = n	*****1.4* − *0.6* = n	n − *0.6* = *0.8*
1.4 − n = *0.8*	*1.4* − n = *0.6*	n − *0.8* = *0.6*

➤ **What are the parts in any addition equation? *addends* the whole? *sum***
➤ **What are the parts in any subtraction equation? *subtrahend and difference* the whole? *minuend***

4. Guide the students in drawing a part-whole model for each equation. Point out that some of the models will look the same because a missing addend and a missing subtrahend can represent the same missing part.
➤ **When you know the parts, what operation helps you solve for the whole? *addition***
➤ **When you know the whole and one part, what operation helps you solve for the missing part? *subtraction***
5. Explain that addition and subtraction are *inverse operations* because addition joins parts to make a whole and subtraction removes a part from the whole, leaving a remaining part. Guide the students in identifying the equation(s) for each missing part and for the whole in step 3 that will help you solve for *n*. ***See the asterisked (*) equations.***

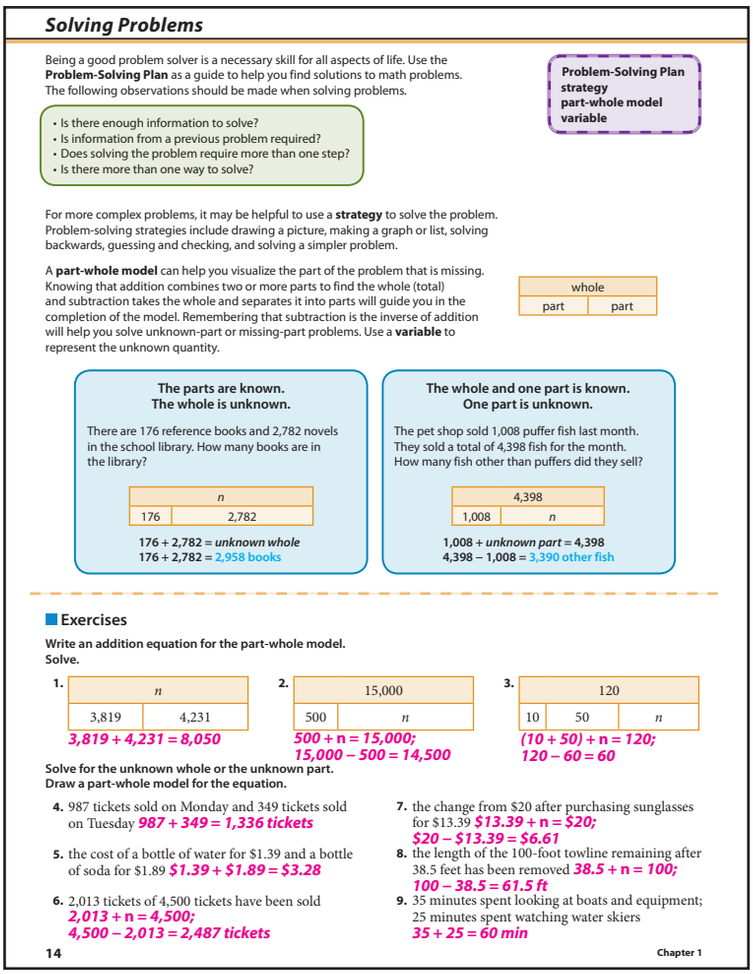
Use a part-whole model to solve word problems

Gina paid for a used car in two payments. Her first payment was $1,200.00. The total amount paid was $3,258.00. What was the amount of her second payment? *$2,058.00*

1. Instruct the students to draw on paper a part-whole model, using the variable *n*, to represent the word problem. Write the equations as the students answer these questions.
➤ **In which section of your model did you write the variable? Why? *A part section; the problem gives the whole ($3,258.00) and one part ($1,200.00), so you need to find the other part.***
➤ **What 4 equations can you write for this model? *$1,200.00* + n = *$3,258.00;* n + *$1,200.00* = *$3,258.00; $3,258.00* − n = *$1,200.00; $3,258.00* − *$1,200.00* = n**
➤ **Which of these equations can you use to clearly state what *n* is equal to? *$3,258.00* − *$1,200.00* = n**
   Explain that an equation that helps you solve for a variable can *begin* with the variable.
➤ **How can we rewrite this equation so that it begins with *n*? n = *$3,258.00* − *$1,200.00***
   Direct the students to solve the problem.
➤ **What is the value of *n*? *$2,058.00***
   Write *n* = $2,058.00 below *n* = $3,258.00 − $1,200.00.
2. Follow a similar procedure for these word problems.

Jared had $764.39 in a savings account. He withdrew some of his money to go to camp. Jared now has $589.39 in his account. How much money did he withdraw? *$175.00*

➤ **In which section of your model did you write the variable? Why? *A part section; the problem gives the whole ($764.39) and one part ($589.39), so you need to find the other part.***
➤ **What 4 equations can you write for this model? n + *$589.39* = *$764.39;* *$589.39* + n = *$764.39;* *$764.39* − n = *$589.39;* *$764.39* − *$589.39* = n**
➤ **What equation can you use to solve for *n*? n = *$764.39* − *$589.39***
➤ **What is the value of *n*? n = *$175.00***



Solving Problems

Being a good problem solver is a necessary skill for all aspects of life. Use the **Problem-Solving Plan** as a guide to help you find solutions to math problems. The following observations should be made when solving problems.

- Is there enough information to solve?
- Is information from a previous problem required?
- Does solving the problem require more than one step?
- Is there more than one way to solve?

Problem-Solving Plan
strategy
part-whole model
variable

For more complex problems, it may be helpful to use a **strategy** to solve the problem. Problem-solving strategies include drawing a picture, making a graph or list, solving backwards, guessing and checking, and solving a simpler problem.

A **part-whole model** can help you visualize the part of the problem that is missing. Knowing that addition combines two or more parts to find the whole (total) and subtraction takes the whole and separates it into parts will guide you in the completion of the model. Remembering that subtraction is the inverse of addition will help you solve unknown-part or missing-part problems. Use a **variable** to represent the unknown quantity.

whole	
part	part

The parts are known. The whole is unknown.

There are 176 reference books and 2,782 novels in the school library. How many books are in the library?

n	
176	2,782

176 + 2,782 = *unknown whole*
176 + 2,782 = 2,958 books

The whole and one part is known. One part is unknown.

The pet shop sold 1,008 puffer fish last month. They sold a total of 4,398 fish for the month. How many fish other than puffers did they sell?

4,398	
1,008	*n*

1,008 + *unknown part* = 4,398
4,398 – 1,008 = 3,390 other fish

Exercises

Write an addition equation for the part-whole model.
Solve.

1.

n	
3,819	4,231

3,819 + 4,231 = 8,050

2.

15,000	
500	*n*

500 + n = 15,000; 15,000 – 500 = 14,500

3.

120		
10	50	*n*

(10 + 50) + n = 120; 120 – 60 = 60

Solve for the unknown whole or the unknown part. Draw a part-whole model for the equation.

4. 987 tickets sold on Monday and 349 tickets sold on Tuesday *987 + 349 = 1,336 tickets*
5. the cost of a bottle of water for $1.39 and a bottle of soda for $1.89 *$1.39 + $1.89 = $3.28*
6. 2,013 tickets of 4,500 tickets have been sold *2,013 + n = 4,500; 4,500 – 2,013 = 2,487 tickets*
7. the change from $20 after purchasing sunglasses for $13.39 *$13.39 + n = $20; $20 – $13.39 = $6.61*
8. the length of the 100-foot towline remaining after 38.5 feet has been removed *38.5 + n = 100; 100 – 38.5 = 61.5 ft*
9. 35 minutes spent looking at boats and equipment; 25 minutes spent watching water skiers *35 + 25 = 60 min*

Solve.

10. It will take Jay, Nathan, and Uncle Paul 2 hours to get to the water-skiing show. Nathan brought a 40-minute CD and a 75-minute CD. How many minutes short of 2 hours are the CDs? *40 min + 75 min = 115 min; 120 min – 115 min = 5 min*
11. Tickets for entrance to the water park cost $16.95 for adults and $11.95 for students. Jay and Nathan qualify for the student entrance fee. What will the ticket cost be for Uncle Paul, Jay, and Nathan? *$16.95 + ($11.95 + $11.95) = $40.85*
12. It costs $1.25 extra for the shows. What will the total ticket price be if they each attend 2 shows? *($1.25 + $1.25) + ($1.25 + $1.25) + ($1.25 + $1.25) = $7.50; $7.50 + $40.85 = $48.35*
13. A three-passenger jet ski displayed at the show costs $8,500. It has a 16.4-gallon gas tank. The one-passenger jet ski has a 4.5-gallon gas tank. What is the difference in size of the fuel tanks? *16.4 gal – 4.5 gal = 11.9 gal*
14. A water-skiing course is set up with buoys in the formation shown below. What is the perimeter of the course? *30 yd + 45 yd + 45 yd + 45 yd + 45 yd + 30 yd + 25 yd + 30 yd + 45 yd + 45 yd + 45 yd + 45 yd + 30 yd + 25 yd = 530 yd*

30 yd, 45 yd, 45 yd, 45 yd, 45 yd, 30 yd
25 yd, 25 yd
30 yd, 45 yd, 45 yd, 45 yd, 45 yd, 30 yd

Practice & Application

15. Find the sum of 17,060 and 31,931,501. *31,948,561*
16. Estimate the difference between 27,400 and 11,790 using front-end estimation. *16,000*
17. Round the number to the nearest ten thousand.
    1,576,284 84,970 360,483 9,642
    1,580,000 80,000 360,000 10,000
18. Write 39,460; 39,466; 39,409; and 39,406 from *greatest* to *least*. *39,466; 39,460; 39,409; 39,406*
19. Write the largest three-digit whole number. *999*
20. Write the smallest three-digit whole number. *100*
21. Round 17,486 to the nearest one thousand to give the approximate number of fliers distributed to announce the grand opening of Steve's Sandwich Shoppe. *17,000*

Journal Entry: Explain how knowing that addition and subtraction are inverse operations can help you solve 89 + *n* = 165. *Answers will vary. Knowing that subtraction undoes addition allows me to write these equations to solve: 89 + n = 165; 165 – 89 = 76.*

Complete DAILY REVIEW 1 on page 404.

Matt's parents started a college savings account for him several years ago. For Matt's first year of college, his parents used $9,484.00 from the account. After his first year, there was $27,516.00 remaining in the account. How much money was in the account before his first year of college? *$37,000.00*

- In which section of your model did you place the variable? Why? *The whole section; the problem gives both parts ($9,484.00 and $27,516.00), so you need to find the whole.*
- What 4 equations can you write for this model? n − *$9,484.00 = $27,516.00;* n − *$27,516.00 = $9,484.00; $9,484.00 + $27,516.00 =* n*; $27,516.00 + $9,484.00 =* n
- What equation can you use to solve for *n*? n = *$9,484.00 + $27,516.00*
- What is the value of *n*? n = *$37,000.00*

Solve multi-step problems

1. Explain that problem solving can be challenging because problems are written so that the solver has to analyze the problem and plan a way to solve it. Some problems include extra information that is not needed; other problems require you to do more than one calculation or more than one step to find the answer.
2. Display the Problem-Solving Plan page. Guide the students in using the plan and the part-whole models to solve these word problems.

Mr. Melbourne has 29 blue folders, 17 green folders, 36 red folders, and 18 purple notebooks. How many folders does he have in all? *82 folders*

- What information is needed to solve the problem? *the number of blue (29), green (17), and red (36) folders*
- What information is given that is not needed? *18 purple notebooks*
- Are you solving for a whole or a part? *whole*

3. Direct the students to draw a part-whole model using only the needed information and then to write an equation on paper and solve it. Choose students to show their models and to tell the steps they used to solve the problem. *model: missing whole, order of the 3 parts (29, 17, and 36) may vary;* n = *29 + 17 + 36;* n = *82 folders*

Jackson has $25.75. He earned $3.50 and $2.25 doing miscellaneous jobs at his house. A neighbor paid Jackson to mow his lawn. How much did the neighbor pay Jackson? *$20.00*

- Is any extra information given in this word problem? *no*
- Are you solving for a whole or a part? *part*
- Do you think you can have more than 2 parts in a part-whole model? *Elicit that you can have any number of parts.*

4. Direct the students to draw a part-whole model using the needed information and then to write an equation on paper and solve it. Remind the students that parentheses are used in multi-step problems to indicate which part of the equation to solve first. Choose students to explain their models and equations. *model: missing one of 3 parts (*n*, $3.50, and $2.25), whole ($25.75);* n = *$25.75 − ($3.50 + $2.25);* n = *$20.00*
5. **Christian Worldview Shaping (CD)**

Student Text pp. 14–15

(***Note***: *Assessment* available on Teacher's Toolkit CD.)

Lesson 7 — **Student Text** pp. 16–17; **Daily Review** p. 405g

Objectives
- Compare and order positive and negative numbers
- Identify the number that is 1 more or 1 less
- Plot positive and negative numbers on a number line
- Add positive and negative numbers using a number line

Teacher Materials
- Number Line
- Thermometer and Red Strip
- Positive & Negative Number Line, page IA4 (CD)

Student Materials
- Number Line

Teach for Understanding

Compare and order positive and negative numbers

1. Distribute the Number Lines and display your Number Line. Point out that for every positive number to the right of zero there is an opposite negative number to the left of zero. Point to each number on the number line as you lead in counting from 1 to 10 and then from −1 to −10.

➤ **What direction on the number line do you move when you count from positive 1 to positive 10?** ***right*** **negative 1 to negative 10?** ***left***

Explain that all positive numbers have a value greater than 0, and all negative numbers have a value less than 0. When you move to the right on a number line you move in a *positive direction*, and the values of the numbers increase. Positive numbers increase in value as you move farther from zero, while negative numbers increase in value as you move closer to zero. When you move to the left on a number line you move in a *negative direction*, and the values of the numbers decrease. Positive numbers decrease in value as you move closer to zero, while negative numbers decrease in value as you move farther from zero.

2. Write 10 __ 6 for display.

➤ **What math symbol can you write to compare these positive numbers? Why?** ***Greater than, >; answers may vary, but elicit that positive 10 is farther to the right on the Number Line than positive 6, and positive numbers increase in value as you move farther from 0.*** Complete the number sentence.

3. Follow a similar procedure for −12 __ −4. ***Less than, <; elicit that negative 12 is farther from 0 than negative 4, and negative numbers decrease in value as you move farther from 0.*** Complete the number sentence.

4. Write 6 __ −4 for display. Choose a student to point to 6 and −4 on the Number Line.

➤ **What math symbol can you write to compare positive 6 to negative 4? Why?** ***Greater than, >; answers may vary, but elicit that a positive number has a greater value than a negative number.*** Complete the number sentence.

5. Write the numbers −12, 10, −4, and 6 for display. Draw 4 answer blanks. Write *least* below the first blank and *greatest* below the last blank.

➤ **Which of these numbers has the least value? How do you know?** ***Negative 12; elicit that negative 12 is farther left on the Number Line than the other numbers being ordered.***

Write −12 on the answer blank labeled *least*.

➤ **Which number has the greatest value? Why?** ***Positive 10; elicit that of the 4 numbers being ordered, positive 10 is farthest to the right on the Number Line.***

Write 10 on the answer blank labeled *greatest*.

6. Guide the students in completing the order. Point out that when you order numbers from least to greatest, you are moving in a positive direction on the Number Line. ***−12, −4, 6, 10***

7. Follow a procedure similar to steps 2–5 as you guide the students in first comparing 11 < 20, −7 > −17, and −7 < 11 and then in ordering 11, −7, 20, and −17 from least to greatest. ***−17, −7, 11, 20***

8. Repeat the procedure for 3, −7, −2, and −6. ***−7, −6, −2, 3***

Identify the number that is 1 more or 1 less

1. Point to 6 on the Number Line.

➤ **What number is 1 more than 6?** ***7*** **than 3?** ***4*** **than 8?** ***9***

➤ **Do you move in a positive direction or a negative direction to find the number that is 1 more? Why?** ***Positive direction; elicit that 1 more is an increase of 1.***

2. Point to −5 on the Number Line.

➤ **What number is 1 more than −5?** ***−4*** Remind students to move in a positive direction.

➤ **Which number is 1 more than −8?** ***−7*** **than −3?** ***−2*** **than −1?** ***0***

3. Follow a similar procedure as you guide the students in identifying the number that is 1 less. Elicit that you move in a negative direction to identify numbers that are 1 less.

➤ **Which number is 1 less than 7?** ***6*** **than 10?** ***9*** **than −9?** ***−10*** **than −3?** ***−4***

Plot positive and negative numbers on a number line

1. Remind the students that the spaces on a number line represent *units* and that you write the numbers that show the distance (the number of units) from 0 below the marks on a number line, similar to the numbers that show inches on a ruler.

➤ **What are the numbers to the right of 0 on a number line called?** ***positive numbers*** **to the left of 0?** ***negative numbers***

2. Direct the students to draw a number line on paper and partition the distance into equal units to show the number of units between negative 4 and positive 4.

➤ **How many units did you partition to the right of 0 on your number line?** ***4*** **to the left of 0?** ***4***

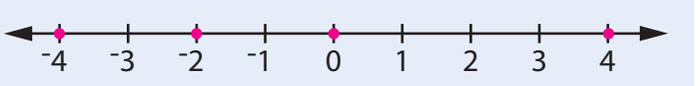
Point out that a number and its opposite (i.e., 4 and −4, 1 and −1, 2 and −2) will always be the same number of units from 0 on a number line.

➤ **What number is 3 units to the right of 0 on your number line?** ***positive 3*** **3 units to the left of 0?** ***negative 3***

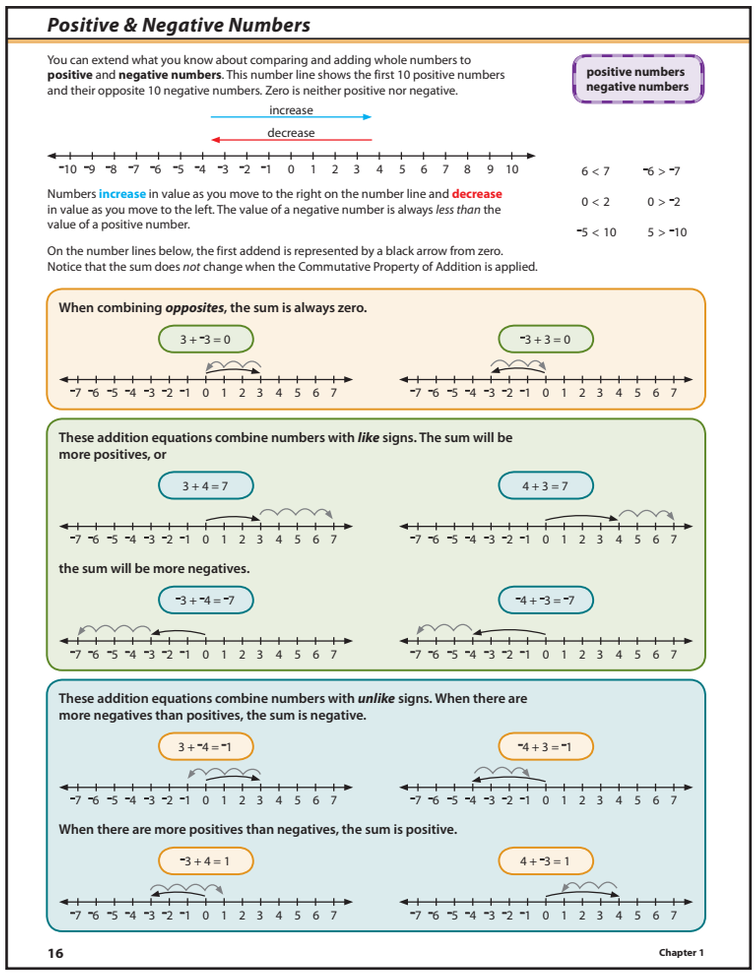
Select a student to draw the number line for display.

3. Direct the students to plot 0, 4, −4, and −2 on their number lines and then to write the plotted numbers in order from least to greatest.

Choose students to plot the numbers on the displayed number line and to write the plotted numbers in least-to-greatest order. ***−4, −2, 0, 4***



4. Follow a similar procedure for 6, −6, 3.5, −3.5 ***−6, −3.5, 3.5, 6*** and −5, 2, 5, 0 ***−5, 0, 2, 5***, directing the students to draw a



Positive & Negative Numbers

You can extend what you know about comparing and adding whole numbers to **positive** and **negative numbers**. This number line shows the first 10 positive numbers and their opposite 10 negative numbers. Zero is neither positive nor negative.

positive numbers
negative numbers

increase
decrease

−10 −9 −8 −7 −6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6 7 8 9 10

Numbers **increase** in value as you move to the right on the number line and **decrease** in value as you move to the left. The value of a negative number is always *less than* the value of a positive number.

6 < 7 −6 > −7
0 < 2 0 > −2
−5 < 10 5 > −10

On the number lines below, the first addend is represented by a black arrow from zero. Notice that the sum does *not* change when the Commutative Property of Addition is applied.

When combining *opposites*, the sum is always zero.

3 + −3 = 0 −3 + 3 = 0

These addition equations combine numbers with *like* signs. The sum will be more positives, or

3 + 4 = 7 4 + 3 = 7

the sum will be more negatives.

−3 + −4 = −7 −4 + −3 = −7

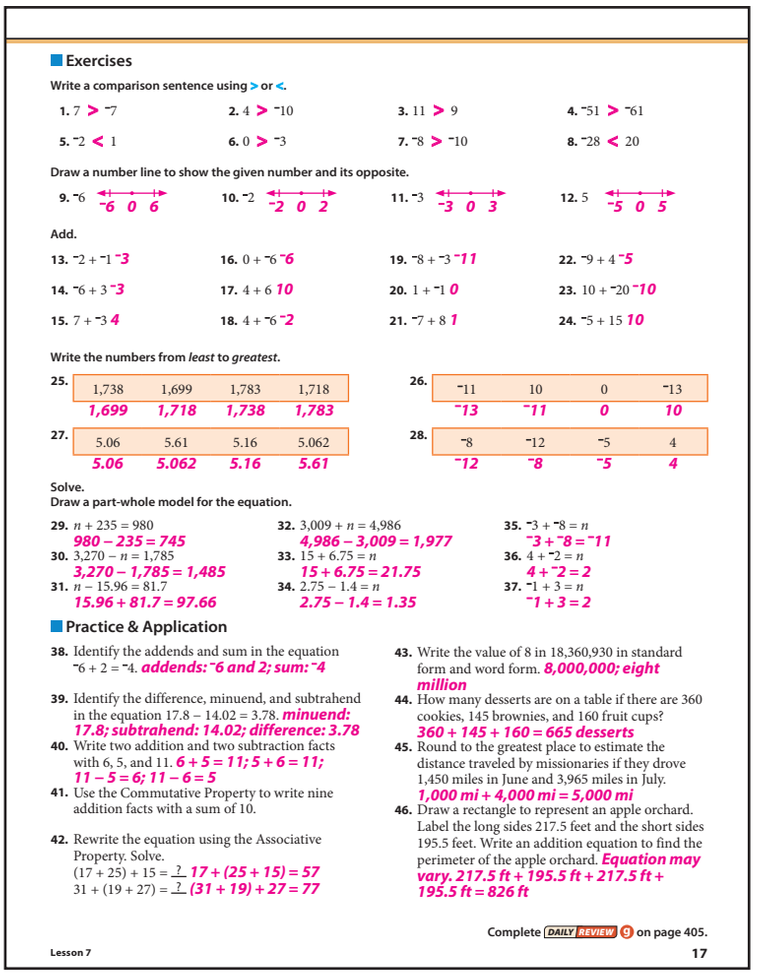
These addition equations combine numbers with *unlike* signs. When there are more negatives than positives, the sum is negative.

3 + −4 = −1 −4 + 3 = −1

When there are more positives than negatives, the sum is positive.

−3 + 4 = 1 4 + −3 = 1

16 Chapter 1



Exercises

Write a comparison sentence using > or <.

1. 7 > −7
2. 4 > −10
3. 11 > 9
4. −51 > −61
5. −2 < 1
6. 0 > −3
7. −8 > −10
8. −28 < 20

Draw a number line to show the given number and its opposite.

9. −6 −6 0 6
10. −2 −2 0 2
11. −3 −3 0 3
12. 5 −5 0 5

Add.

13. −2 + −1 −3
14. −6 + 3 −3
15. 7 + −3 4
16. 0 + −6 −6
17. 4 + 6 10
18. 4 + −6 −2
19. −8 + −3 −11
20. 1 + −1 0
21. −7 + 8 1
22. −9 + 4 −5
23. 10 + −20 −10
24. −5 + 15 10

Write the numbers from *least* to *greatest*.

25. 1,738 1,699 1,783 1,718 — 1,699 1,718 1,738 1,783
26. −11 10 0 −13 — −13 −11 0 10
27. 5.06 5.61 5.16 5.062 — 5.06 5.062 5.16 5.61
28. −8 −12 −5 4 — −12 −8 −5 4

Solve.
Draw a part-whole model for the equation.

29. $n + 235 = 980$ — 980 − 235 = 745
30. $3{,}270 - n = 1{,}785$ — 3,270 − 1,785 = 1,485
31. $n - 15.96 = 81.7$ — 15.96 + 81.7 = 97.66
32. $3{,}009 + n = 4{,}986$ — 4,986 − 3,009 = 1,977
33. $15 + 6.75 = n$ — 15 + 6.75 = 21.75
34. $2.75 - 1.4 = n$ — 2.75 − 1.4 = 1.35
35. $-3 + -8 = n$ — −3 + −8 = −11
36. $4 + -2 = n$ — 4 + −2 = 2
37. $-1 + 3 = n$ — −1 + 3 = 2

Practice & Application

38. Identify the addends and sum in the equation −6 + 2 = −4. addends: −6 and 2; sum: −4
39. Identify the difference, minuend, and subtrahend in the equation 17.8 − 14.02 = 3.78. minuend: 17.8; subtrahend: 14.02; difference: 3.78
40. Write two addition and two subtraction facts with 6, 5, and 11. 6 + 5 = 11; 5 + 6 = 11; 11 − 5 = 6; 11 − 6 = 5
41. Use the Commutative Property to write nine addition facts with a sum of 10.
42. Rewrite the equation using the Associative Property. Solve.
(17 + 25) + 15 = ? 17 + (25 + 15) = 57
31 + (19 + 27) = ? (31 + 19) + 27 = 77
43. Write the value of 8 in 18,360,930 in standard form and word form. 8,000,000; eight million
44. How many desserts are on a table if there are 360 cookies, 145 brownies, and 160 fruit cups? 360 + 145 + 160 = 665 desserts
45. Round to the greatest place to estimate the distance traveled by missionaries if they drove 1,450 miles in June and 3,965 miles in July. 1,000 mi + 4,000 mi = 5,000 mi
46. Draw a rectangle to represent an apple orchard. Label the long sides 217.5 feet and the short sides 195.5 feet. Write an addition equation to find the perimeter of the apple orchard. Equation may vary. 217.5 ft + 195.5 ft + 217.5 ft + 195.5 ft = 826 ft

Complete DAILY REVIEW 9 on page 405.

Lesson 7 17

number line from −6 to 6. Guide the students to the conclusion that 3.5 is located halfway between 3 and 4 and that −3.5 is located halfway between −3 and −4.

5. Instruct the students to write these numbers in order from least to greatest without using a number line.
   −1, −7, −5, 1 *−7, −5, −1, 1* −2, 4, 3, −6 *−6, −2, 3, 4*

Add positive and negative numbers

1. Display the Positive & Negative Number Line page and write 4 + 3 = __ for display. Demonstrate adding the numbers on the number line as shown on Student Text page 16; begin at zero and jump to the first addend (4), and then jump the amount of the second addend (3).
   ➤ **What does 4 + 3 equal?** *7* Choose a student to complete the equation.
   Point out that you had positive 4 and added positive 3 more. Since both addends are positive, you moved 4 in a positive direction and then you moved 3 more in a positive direction.
2. Erase the jumps on the transparency and write −4 + −3 = __ for display.
   Select a student to demonstrate adding the negative numbers on the number line. Guide him as he jumps in a negative direction from 0 to the first addend (−4) and then moves negative 3 more, continuing in a negative direction.
   ➤ **What does −4 + −3 equal?** *−7* Choose a student to complete the equation.
   Point out that you moved 4 in a negative direction and then you moved 3 more in a negative direction.
3. Repeat the procedure for 4 + −3 = __. Point out that you began by moving 4 in a positive direction from 0 and then you moved 3 in a negative direction. *1*
4. Repeat the procedure for 3 + −4 = __. Point out that you began by moving 3 in a positive direction from 0 and then you moved 4 in a negative direction. *−1*
5. Follow a similar procedure for 5 + −5 = *0* and −4 + 4 = *0*. Explain that adding a number and its opposite (negative and positive) will always equal zero.
   Choose students to write other equations that equal zero and to demonstrate the addition on the number line.
6. Display the Thermometer. Demonstrate solving equations for the following word problem and other similar problems, using the thermometer like a number line; begin at 0°F and move in the direction indicated by the equation to find the sum. Select students to write for display the equation for each word problem.

> On Monday afternoon, the temperature was 15°F. By that evening, the temperature had dropped 5°F. What was the temperature Monday evening? *15 + −5 = 10°F*

(***Note:*** Some students may write the subtraction equation 15 − 5 = 10°F for this word problem. If so, explain that both equations represent the word problem and that adding −5 is the same as subtracting 5.)

Student Text pp. 16–17

Lesson 8

Student Text pp. 18–19
Daily Review p. 405h

Objectives
- Read and write Roman numerals
- Complete a sequence of Roman numerals

Teacher Materials
- Chart 1: *Roman Numerals*
- Roman Numeral Clock
- Roman Numerals, page IA5 (CD)

Student Materials
- Roman Numeral Sequences, page IA6 (CD)

Note
This lesson emphasizes the understanding of place value in other forms rather than the mastery of the Roman system of writing numbers.

Introduce the Lesson

Display the Roman Numeral Clock. Point out that the symbols on the clock are Roman numerals.

➤ **What symbol on the clock represents 1?** ***I*** **5?** ***V*** **10?** ***X***

➤ **Where might you see Roman numerals other than on some clocks and watches?** ***possible answers: the beginning pages and copyright dates in books, outlines, dates on monuments or buildings, names, titles***

The Roman numerical system was developed long ago, but Roman numerals are still seen in many places today. If you visit a museum or an antique shop, you will notice Roman numerals on coins, artwork, clocks, sundials, and other objects. Roman numerals are used in books, in the designation of sequels to films, and in the numbering of major championships in sports (e.g., the Olympics, the Super Bowl, and the World Series).

Some people use their hands to remember what numbers Roman numerals represent. The symbols *I*, *II*, and *III* can be pictured by holding up 1, 2, or 3 fingers. When you stretch out all 5 fingers on one hand, the lines formed by your thumb and little finger make a *V*. An *X* is formed when you stretch out both of your hands and hold both "*V*s" together near your wrist.

Teach for Understanding

Write Roman numerals

1. Display the *Roman Numerals* chart and direct attention to the symbols for 1, 5, 10, 50, 100, 500, and 1,000. Explain that the Roman system consists of these 7 symbols to write numbers; however, the system has no way to express the concept of 0.
2. Guide the students in listing the Roman numerals from 1 through 10 vertically on paper as you write them vertically for display. Point to each numeral on the chart and explain how it is formed.
3. Choose students to read aloud the rules for writing Roman numerals. Explain each rule after it is read.

➤ **Why do you think the Roman numerical system is referred to as an "Additive-Subtractive" system?** ***Elicit that instead of having a unique numeral or symbol for each number, you add or subtract to make numbers.***

➤ **Which rule explains why 9 is written** ***IX*** **instead of** ***VIIII*****?** ***Rule 1: A symbol (letter) can be used only 3 times in a row.***

4. Choose students to write the Roman numerals for 11 through 20 vertically beside the Roman numerals for 1–10 (i.e., *XI* beside *I*, *XII* beside *II*, *XIII* beside *III*, and so on). ***XI, XII, XIII, XIV, XV, XVI, XVII, XVIII, XIX, XX***

➤ **What "Additive-Subtractive" pattern do you see in the Roman numerals for 11–20?** ***Accept correct answers.***

5. Guide the students in counting by 10s to 100 while they list the Roman numerals on their paper. Write each numeral as the students write it and discuss the pattern used to write it: *X*, *XX*, *XXX*, *XL*, *L*, *LX*, *LXX*, *LXXX*, *XC*, and *C*.
6. Explain that it is helpful to use place value and write the expanded form of a number before writing a Roman numeral. Point out that while our Arabic system uses one digit in each place to express values (63 = 6 tens and 3 ones), the Roman system can use more than one symbol to represent a value (LX = 6 tens and III = 3 ones).

➤ **What is the expanded form for 41 in our Arabic numerical system?** ***40 + 1*** Write 40 + 1 for display.

➤ **How could you write 40 + 1 using Roman numerals?** ***XL + I*** Write *XL + I*.

➤ **Since Roman numerals do not use a plus sign, what is the Roman numeral for 41?** ***XLI*** Write *XLI*.

7. Follow a similar procedure for these numbers.
   - 45 = ***40 + 5; XL + V; XLV***
   - 69 = ***60 + 9; LX + IX; LXIX***
   - 84 = ***80 + 4; LXXX + IV; LXXXIV***
   - 99 = ***90 + 9; XC + IX; XCIX***
8. Follow a procedure similar to steps 5–7 for Roman numerals from 100 through 1,000: *C*, *CC*, *CCC*, *CD*, *D*, *DC*, *DCC*, *DCCC*, *CM*, and *M*.

➤ **How does place value help you to write Roman numerals?** ***Elicit that writing the value of each place in expanded form helps you use the appropriate symbols in the correct order.***

➤ **What is the expanded form for 368 in our base ten system?** ***300 + 60 + 8***

➤ **How could you write 300 + 60 + 8 using Roman numerals?** ***CCC + LX + VIII***

➤ **What is the Roman numeral for 368?** ***CCCLXVIII***

9. Repeat the procedure for these numbers.
   - 145 = ***100 + 40 + 5; C + XL + V; CXLV***
   - 429 = ***400 + 20 + 9; CD + XX + IX; CDXXIX***
   - 784 = ***700 + 80 + 4; DCC + LXXX + IV; DCCLXXXIV***
   - 999 = ***900 + 90 + 9; CM + XC + IX; CMXCIX***

Complete a sequence of Roman numerals

1. Display the Roman Numerals page. Point out the place values at the top and digits 1–9 on the right side of the chart. Allow the students a few minutes to analyze the chart.

➤ **How could you use this chart to write an Arabic number as a Roman numeral?** ***Answers will vary, but elicit that the Roman numeral for a digit in an Arabic number is located in the column showing the place value of the digit.***

2. Ask a student to name a number from 1 through 1,000. Write the Arabic number for display. Demonstrate using the chart to write the value of each digit in the Roman numeral, e.g., 356—in the Hundreds column find the symbols for 300

Roman Numerals

The Roman numeration system was developed in Rome sometime between 500 BC and AD 100. It is an "additive-subtractive" system, which means that the value of the numeral is based on the position of the numeral within the number.

Roman numerals are typically used for clocks, in names, as chapter numbers in books, and to display years or special events (e.g., Super Bowl).

Roman numerals follow a pattern using symbols.

I = 1 V = 5 X = 10 L = 50 C = 100 D = 500 M = 1,000

- The symbol for 1, 10, or 100 should be used no more than 3 times in a row.
  VIII = 8 because 5 + 1 + 1 + 1 = 8 DCC = 700 because 500 + 100 + 100 = 700
- When a lesser symbol comes *after* a greater symbol, the lesser symbol is *added* to the greater symbol.
  LVI = 56 because 50 + 5 + 1 = 56 MDCI = 1,601 because 1,000 + 500 + 100 + 1 = 1,601
- When a lesser symbol (**I**, **X**, or **C**) comes *before* a greater symbol, the lesser symbol is *subtracted* from the greater symbol. (Only one symbol may be written to the left to subtract.)
  IX = 9 because 10 – 1 = 9 CM = 900 because 1,000 – 100 = 900

Writing a Roman numeral in expanded form can help you determine the number. Super Bowl XLV was won by the Green Bay Packers in the year MMXI.

XLV = 40 + 5 = 45 MMXI = 2,000 + 11 = 2,011

Exercises

Write the number in Roman numerals.

1. 16 *XVI*
2. 34 *XXXIV*
3. 97 *XCVII*
4. 116 *CXVI*
5. 548 *DXLVIII*
6. 844 *DCCCXLIV*
7. 1,321 *MCCCXXI*
8. 2,915 *MMCMXV*

Write the Roman numeral in standard form.

9. DLV *555*
10. XLIII *43*
11. LXXIX *79*
12. LXXVIII *78*
13. MDCVII *1,607*
14. XXXIX *39*
15. CCCLII *352*
16. CXCIV *194*

Write the answer.

17. Brent wrote 104 as CIII. Was he correct? *No, the answer is CIV.*
18. Janelle has read chapters 1–8 of the novel she is reading for a book report. List the Roman numerals for the chapters she has read. *I, II, III, IV, V, VI, VII, VIII*
19. The minute and hour hand point to XII. What time is it? *12:00*
20. Write the page number of this page in Roman numerals. *XVIII*
21. Write the Roman numeral of the Olympic Games that follow the 28th games. *XXIX*
22. George wrote his age 30 as XXL. What did he do wrong? Write his age correctly. *Only 1 smaller unit may come before a larger unit; XXX.*
23. Write 1,437 in Roman numerals. *MCDXXXVII*
24. What number cannot be expressed in Roman numerals? *0*

Solve.

25. 75,309 + 6,587 *81,896*
26. 100,915 + 3,960,499 *4,061,414*
27. 7,862 + 20,484 *28,346*
28. 5,000 – 398 *4,602*
29. 176,281 – 29,584 *146,697*
30. 60,400 – 3,419 *56,981*
31. 6.09 + 17.803 *23.893*
32. 21.013 + 34.69 *55.703*
33. 1.14 – 0.36 *0.78*
34. 11.18 – 4.962 *6.218*
35. 10 – 4.65 *5.35*
36. $7 – $6.50 *$0.50*
37. 6 + ⁻6 *0*
38. ⁻1 + 5 *4*
39. 0 + ⁻7 *⁻7*
40. ⁻3 + ⁻8 *⁻11*
41. 4 + ⁻6 *⁻2*
42. ⁻5 + 8 *3*

Round to the greatest place to estimate the sum or difference.

43. 5,728 + 2,970 *9,000*
44. 878.61 + 29.53 *930*
45. 10.007 – 2.96 *7*

Estimate the sum or difference using front-end estimation.

46. 23,475 + 71,608 *94,000*
47. 836,111 + 579,403 *1,400,000*
48. 628,450 – 247,066 *380,000*

Practice & Application

49. Draw a clock with Roman numerals for the hours. Set the clock for 10 minutes before 12 o'clock.
50. Write the current year in Roman numerals. *Answer will vary.*
51. The Roman Colosseum had about 80 entrances. Four of the entrances were reserved for the emperor and his guests. How many entrances were left for the spectators to use? *80 – 4 = 76*
52. The Colosseum was used for about 4 centuries. Write a four-addend equation to show this length of time in years. (1 century = 100 years) *100 + 100 + 100 + 100 = 400 years*
53. The Roman Colosseum was completed in AD 80. Write the Roman numeral for the completion date. *LXXX*

The Roman Colosseum is a great architectural monument. It seated 50,000 spectators. The Roman numeral for 50,000 is $\overline{L}$.

49.

Complete DAILY REVIEW h on page 405.

(3 × 100) *CCC*; Tens column, symbol for 50 (5 × 10) *L*; Ones column, symbols for 6 (6 × 1) *VI*: *CCCLVI*.

Choose students to write other numbers for display and use the chart to write the number as a Roman numeral.

3. Distribute the Roman Numeral Sequences page to the students. Select a student to read the first 3 numbers in the first sequence. *30, 31, 32*

➤ **What are the first 2 numbers missing in sequence 1?** *33 and 34* Choose a student to write the numbers in the sequence. *XXXIII, XXXIV*

➤ **What other numbers are missing from this sequence?** *38 and 39* Choose a student to complete the sequence. *XXXVIII, XXXIX*

4. Repeat the procedure to complete sequences 2–6.

(*Note:* You may choose to place a copy of the Roman Numerals page in a learning center to provide the students with additional opportunities to practice writing Roman numerals. The page can also be used to challenge capable students to write numbers 4,000 and greater. Point out that they will need to use the bar to indicate that the value of the Roman numeral is multiplied by 1,000; e.g., 4,000 = $\overline{IV}$ and 5,000 = $\overline{V}$.)

Read Roman numerals

1. Arrange the students in teams. Explain that to practice reading Roman numerals they will use their Math Student Texts to play a game similar to a "Sword Drill" for locating Bible verses in the Bible. Explain that each student will place his book on his desk until after you have written a Roman numeral for display and called out, "Go." Then each student should quickly turn to that page number in his book and stand up and read the number aloud. The first student to stand up who has located the correct page earns a point for his team.
2. Write these Roman numerals for display as you play the game. Write additional Roman numerals to extend the game.

VIII = *8*	XV = *15*	XXVI = *26*
XLVI = *46*	LXXVIII = *78*	XXXIX = *39*
CXXIII = *123*	CLVI = *156*	CXI = *111*
CLXXIV = *174*	LXII = *62*	CXXXV = *135*
CCLIV = *254*	CCXIX = *219*	LXXXVIII = *88*
CCCXXV = *325*	CCXXII = *222*	CCCIV = *304*
CCXCIX = *299*	CLXXXI = *181*	CCCXIII = *313*

Student Text pp. 18–19

Lesson 9 **Student Text** pp. 20–21
Daily Review p. 406i

Objectives
- Use logic to identify number patterns
- Use a pattern to solve a problem

Teacher Materials
- Number Patterns, page IA7 (CD)
- Patterns, page IA8 (CD)
- An apple
- A small sharp knife
- A Bible
- An overhead calculator

Student Materials
- Patterns, page IA8 (CD)
- A calculator (optional)

Introduce the Lesson

1. Display an apple. Cut the apple into two parts from side to side (horizontally). Show the students that the cut apple has a star-like design. Discuss the patterns and designs seen in God's orderly world (e.g., symmetry in nature, and hexagonal-shaped cells of the honeycomb).
2. Tell the students that seeing these patterns in creation reminds us that Christ has ordered and made our world in amazing ways. Read Revelation 4:10–11. Explain to the students that Jesus Christ is worthy to receive honor and glory because He is the Creator of everything, and He made all of creation for His pleasure.

Teach for Understanding

Use logic to identify number patterns

1. Display the overhead calculator. Enter 7 + 4 =. Choose a student to record the answer (11) for display and also the following numbers in a vertical column as you continue to press the = key: 15, 19, 23, 27, 31, 35, 39, 43, 47.

➤ **What repeating pattern do you see?** ***Elicit that the Ones place has 1, 5, 9, 3, 7 repeated every 5 numbers in this sequence of numbers; add 4 to each number.*** Choose a student to write the next five numbers in the sequence. ***51, 55, 59, 63, 67***

2. Display Pattern 1 only on the Number Patterns page.

➤ **What repeating pattern do you see?** ***Even numbers; add 2 to each number.*** Choose a student to write the next four numbers. ***10, 12, 14, 16***

3. Display Pattern 2.

➤ **What repeating pattern do you see?** ***Elicit that every 2 numbers are added together to give the next number in the sequence.*** Choose a student to write the next 4 numbers. ***13 (5 + 8), 21 (8 + 13), 34 (13 + 21), 55 (34 + 21)*** Remind the students that these numbers are the first few numbers in a sequence devised by the Italian mathematician Fibonacci. (See Student Text page 11.) Choose students to tell the next 5 Fibonacci numbers. ***89, 144, 233, 377, 610***

4. Display Pattern 3.

➤ **What repeating pattern do you see?** ***Elicit that the counting numbers are added consecutively to each number to give the next number in the sequence: 1 + 1 = 2, 2 + 2 = 4, 4 + 3 = 7, 7 + 4 = 11, and so on.*** Choose a student to write the next three numbers in the sequence. ***37 (29 + 8), 46 (37 + 9), 56 (46 + 10)***

5. Display Pattern 4. Explain to the students that sometimes two operations are performed to continue the pattern in a sequence.

➤ **What is added to each number to get the next number?** ***2 + 3 = 5, 5 + 6 = 11, 11 + 12 = 23*** Write + 3, + 6, and + 12 below the corresponding numbers in the sequence. (See the two-operation example at the top right of Student Text page 20.)

➤ **What pattern do you see from 3 to 6 and from 6 to 12?** ***3 × 2 = 6 and 6 × 2 = 12*** Write × 2 below + 3, + 6, and + 12 as in the example on Student Text page 20. Guide the students in applying the × 2 pattern to the first number, 2, in the sequence: 2 × 2 = 4; elicit that the next number, 5, in the sequence is 1 more than 4; so add 1: 4 + 1 = 5.

➤ **What operations did we perform from 2 to give the next number, 5, in the sequence?** ***× 2 + 1; (2 × 2) + 1 = 5*** Choose students to perform the 2 operations from 5 to 11 and from 11 to 23 to see if the 2 operations work for the sequence given. ***(5 × 2) + 1 = 11; (11 × 2) + 1 = 23***

➤ **What is the repeating pattern for the sequence?** ***× 2 + 1; each number is first multiplied by 2, and then 1 is added to continue the sequence.*** Choose a student to perform the 2 operations to write the next three numbers in the sequence. ***(23 × 2) + 1 = 47, (47 × 2) + 1 = 95, (95 × 2) + 1 = 191***

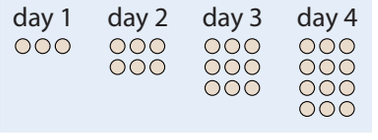
6. Guide the students in discovering the patterns for Pattern 5 ***× 2 − 1: (9 × 2) − 1 = 17; (17 × 2) − 1 = 33; (33 × 2) − 1 = 65*** and Pattern 6 ***× 3 + 1: (40 × 3) + 1 = 121; (121 × 3) + 1 = 364; (364 × 3) + 1 = 1,093***.

Use a pattern to solve a problem

1. Explain that patterns are often used for solving problems.

> Aunt Mary spent each day in September knitting caps for needy children. On the first day she finished a total of 3 caps. By the second day a total of 6 caps were done. On the third day a total of 9 caps were finished. On the fourth day a total of 12 caps were completed. If Aunt Mary continued making the same number of caps each day, how many caps did she make by the 10th of September?

2. Guide the students in first drawing a model on paper as shown below to represent the total number of caps that were completed at the end of each day. Next, guide them in making a chart as shown below to record the same information.
3. Instruct the students to examine the model and the chart to find a pattern. ***possible patterns—days: + 1; caps: + 3; × 3***
4. Choose students to explain how they could find the total number of finished caps based on the model and chart.



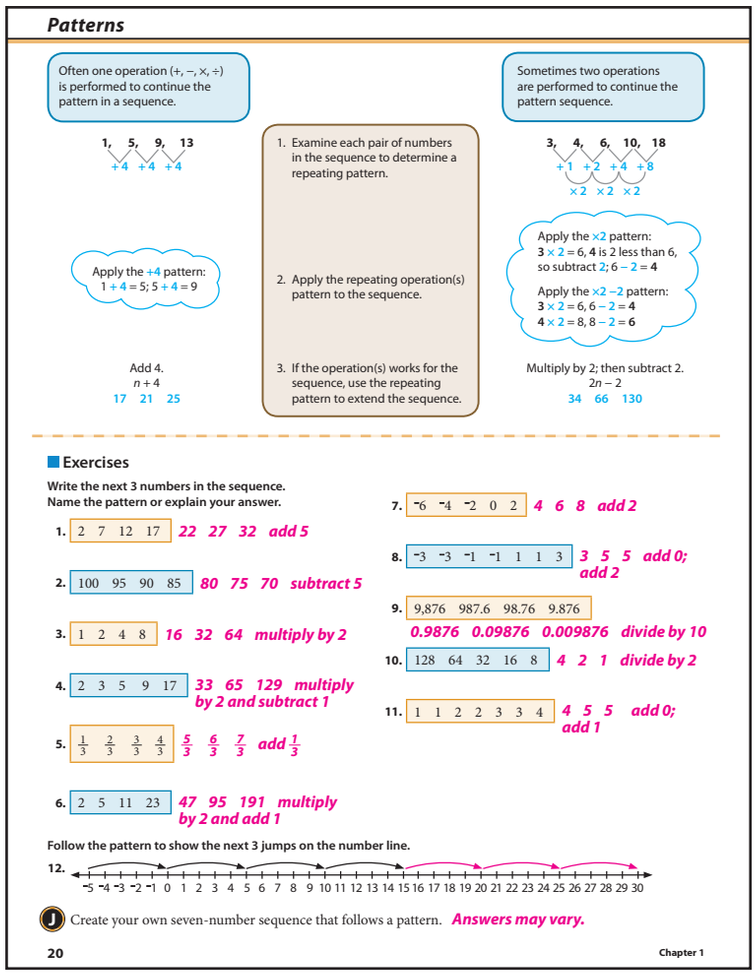
Elicit that you can add 3 to the total number of caps finished each day until you find the total for day 10, or you can multiply the number of the day, 10, by 3.

5. Direct the students to calculate the answer using either method.

➤ **How many caps did Aunt Mary make by September 10th?** ***30***

day	1	×3	2	×3	3	×3	4	×3
total caps finished	3		6		9		12	

6. Direct the students to find the total number of caps finished by the 15th and the 30th of the month. ***45 caps; 90 caps***



Patterns

Often one operation (+, –, ×, ÷) is performed to continue the pattern in a sequence.

1, 5, 9, 13
+4 +4 +4

Apply the +4 pattern:
1 + 4 = 5; 5 + 4 = 9

Add 4.
$n + 4$
17 21 25

1. Examine each pair of numbers in the sequence to determine a repeating pattern.
2. Apply the repeating operation(s) pattern to the sequence.
3. If the operation(s) works for the sequence, use the repeating pattern to extend the sequence.

Sometimes two operations are performed to continue the pattern sequence.

3, 4, 6, 10, 18
+1 +2 +4 +8
×2 ×2 ×2

Apply the ×2 pattern:
3 × 2 = 6, 4 is 2 less than 6, so subtract 2; 6 – 2 = 4

Apply the ×2 –2 pattern:
3 × 2 = 6, 6 – 2 = 4
4 × 2 = 8, 8 – 2 = 6

Multiply by 2; then subtract 2.
$2n - 2$
34 66 130

Exercises

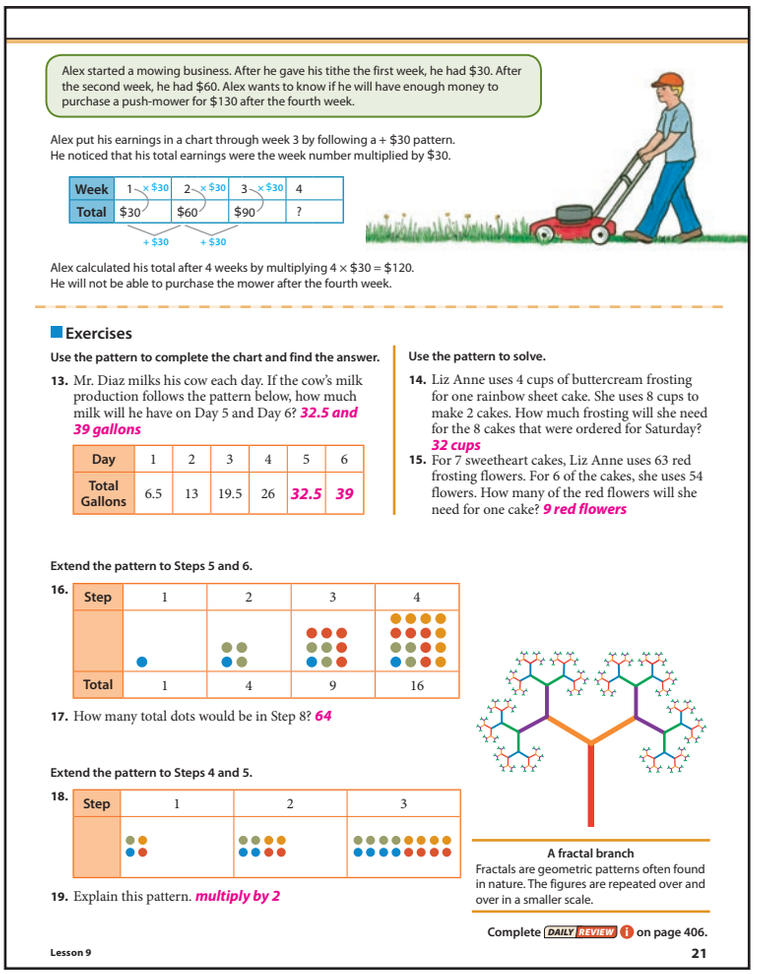
Write the next 3 numbers in the sequence.
Name the pattern or explain your answer.

1. 2 7 12 17 — *22 27 32 add 5*
2. 100 95 90 85 — *80 75 70 subtract 5*
3. 1 2 4 8 — *16 32 64 multiply by 2*
4. 2 3 5 9 17 — *33 65 129 multiply by 2 and subtract 1*
5. $\frac{1}{3}$ $\frac{2}{3}$ $\frac{3}{3}$ $\frac{4}{3}$ — $\frac{5}{3}$ $\frac{6}{3}$ $\frac{7}{3}$ *add* $\frac{1}{3}$
6. 2 5 11 23 — *47 95 191 multiply by 2 and add 1*
7. −6 −4 −2 0 2 — *4 6 8 add 2*
8. −3 −3 −1 −1 1 1 3 — *3 5 5 add 0; add 2*
9. 9,876 987.6 98.76 9.876 — *0.9876 0.09876 0.009876 divide by 10*
10. 128 64 32 16 8 — *4 2 1 divide by 2*
11. 1 1 2 2 3 3 4 — *4 5 5 add 0; add 1*

Follow the pattern to show the next 3 jumps on the number line.

12.

J Create your own seven-number sequence that follows a pattern. *Answers may vary.*



Alex started a mowing business. After he gave his tithe the first week, he had $30. After the second week, he had $60. Alex wants to know if he will have enough money to purchase a push-mower for $130 after the fourth week.

Alex put his earnings in a chart through week 3 by following a + $30 pattern. He noticed that his total earnings were the week number multiplied by $30.

Week	1	2	3	4
Total	$30	$60	$90	?

(×$30, ×$30, ×$30; +$30, +$30)

Alex calculated his total after 4 weeks by multiplying 4 × $30 = $120. He will not be able to purchase the mower after the fourth week.

Exercises

Use the pattern to complete the chart and find the answer.

13. Mr. Diaz milks his cow each day. If the cow's milk production follows the pattern below, how much milk will he have on Day 5 and Day 6? *32.5 and 39 gallons*

Day	1	2	3	4	5	6
Total Gallons	6.5	13	19.5	26	*32.5*	*39*

Use the pattern to solve.

14. Liz Anne uses 4 cups of buttercream frosting for one rainbow sheet cake. She uses 8 cups to make 2 cakes. How much frosting will she need for the 8 cakes that were ordered for Saturday? *32 cups*
15. For 7 sweetheart cakes, Liz Anne uses 63 red frosting flowers. For 6 of the cakes, she uses 54 flowers. How many of the red flowers will she need for one cake? *9 red flowers*

Extend the pattern to Steps 5 and 6.

16.

Step	1	2	3	4
Total	1	4	9	16

17. How many total dots would be in Step 8? *64*

Extend the pattern to Steps 4 and 5.

18.

Step	1	2	3

19. Explain this pattern. *multiply by 2*

A fractal branch
Fractals are geometric patterns often found in nature. The figures are repeated over and over in a smaller scale.

Complete DAILY REVIEW 1 on page 406.

A botanist is studying kudzu, a common plant in his state. He measures one vine on the plant each day and records its length for 4 days. According to the recorded growth pattern, about how long will the vine be on day 8?

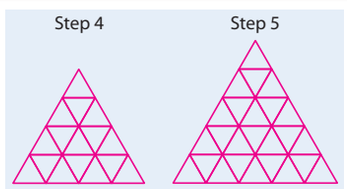
7. Display the following chart (without the pattern answers) and instruct the students to write it on paper.

day	1	2	3	4
length: cm	53.3	73.4	93.6	113.9

(+20.1, +20.2, +20.3)

8. Guide the students in understanding the pattern as shown. You may choose to let students use a calculator to subtract.
   - ➤ How can you know how much the vine has grown each day? *Elicit that you can subtract to find the difference in length between two consecutive days.*
   - ➤ What is the difference in length from day 1 to day 2? *20.1* day 2 to day 3? *20.2* day 3 to day 4? *20.3*
   - ➤ What pattern do you see in the vine's growth? *Elicit that each day the vine grows the same amount as the previous day, plus 1 additional tenth.*
9. Guide the students in extending the pattern in the chart to solve the problem. *5: 134.3 (+ 20.4); 6: 154.8 (+ 20.5); 7: 175.4 (+ 20.6); 8: 196.1 (+ 20.7)*
   - ➤ What is the predicted length of the vine on day 8? *196.1 cm*
10. Distribute and display the Patterns page.
    - ➤ What repeating pattern do you see in the figures? *Elicit that each figure is made up of rows with a consecutively odd number of triangles. A new bottom row is added with each step. (Some students might see a diagonal column added along one side.)*

    Direct the students to record the number of triangles in the figure at each of the first 3 steps. *1, 4, 9*



11. Guide the students in drawing the figures on a sheet of paper and completing the table for Steps 4 and 5. *16, 25*
    - ➤ What repeating number pattern would help you to complete the table without drawing any more figures? *The number of the step is multiplied by itself to find the total number of triangles that make up the figure for that step.*

    Students may find it helpful to have you mark the pattern on the page.

Step	1	2	3	4	5
Number of △	1	4	9	16	25

(×1, ×2, ×3, ×4, ×5)

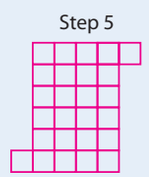
    Choose students to draw the figures and complete the table through Step 9. *6: 36; 7: 49; 8: 64; 9: 81*
12. Follow a similar procedure for the second pattern on the page. *The number of the step is multiplied by itself, and 1 is added to it to find the total number of squares that make up the figure for that step.*

Step	1	2	3	4	5
Number of □	2	5	10	17	26

(×1+1, ×2+1, ×3+1, ×4+1, ×5+1)

6	7	8	9
37	50	65	82

(×6+1, ×7+1, ×8+1, ×9+1)



Student Text pp. 20–21

Lesson 10 **Student Text** pp. 22–23

Chapter Review

Objectives

- Demonstrate an understanding of place value for whole numbers and decimals
- Express whole numbers and decimals in standard form, word form, fraction form, expanded form, and expanded form with multiplication
- Identify the value of the digits in a number
- Round whole numbers and decimals
- Apply addition properties: Commutative Property, Identity Property, and Associative Property
- Apply the Zero Principle of Subtraction
- Estimate, solve, and check addition and subtraction problems with whole numbers and decimals
- Use a part-whole model to solve addition and subtraction word problems
- Read and write Roman numerals

Preparation

Write these equations for display. (Do not write the answers or the estimates.)

256,923 + 602,544 = ***859,467 (900,000)***
4,670,000 + 8,502,044 = ***13,172,044 (14,000,000)***
0.54 + 0.078 = ***0.618 (1)***
2.063 + 0.4589 = ***2.5219 (2)***
372,000 − 126,509 = ***245,491 (300,000)***
8,050,320 − 1,642,053 = ***6,408,267 (6,000,000)***
0.5 − 0.036 = ***0.464 (1)***
5.4070 − 2.76 = ***2.647 (2)***

Note

This lesson reviews the concepts presented in Chapter 1 to prepare the students for the Chapter 1 Test. Student Text pages 22–23 provide the students with an excellent study guide.

Check for Understanding

Demonstrate an understanding of place value

1. Write 403,078,620,105 for display and use the number to review the following concepts.

   Read aloud: ***four hundred three billion, seventy-eight million, six hundred twenty thousand, one hundred five***

   Value of digits: Hundred Thousands place ***600,000***, One Billions place ***3,000,000,000***, and so on.

   1 (also 10; 100; 1,000; 10,000; and so on) greater than: ***403,078,620,106***

   1 (also 10; 100; 1,000; 10,000; and so on) less than: ***403,078,620,104***

   Round to the greatest place: ***400,000,000,000***

   Round to a given place: One Millions ***403,079,000,000***, Ten Thousands ***403,078,620,000***, and so on.

   Written word form: ***four hundred three billion, seventy-eight million, six hundred twenty thousand, one hundred five***

   Expanded form: ***400,000,000,000 + 3,000,000,000 + 70,000,000 + 8,000,000 + 600,000 + 20,000 + 100 + 5***

   Expanded form with multiplication: ***(4 × 100,000,000,000) + (3 × 1,000,000,000) + (7 × 10,000,000) + (8 × 1,000,000) + (6 × 100,000) + (2 × 10,000) + (1 × 100) + (5 × 1)***
2. Repeat the activity with another number if needed.
3. Write 6.50367 for display. Select a student to read the decimal aloud.

   ➤ **What digit is in the Tenths place? *5* What is its value? *5 tenths***
   Repeat the question for the Thousandths place ***3; 3 thousandths*** and the Hundred Thousandths place ***7; 7 hundred thousandths***.

   ➤ **How does rounding to a decimal place differ from rounding to a whole number place? *You do not have to replace the digits to the right of the rounding place with zeros since the zeros will not change the value of the decimal.***

   ➤ **What is 6.50367 rounded to the nearest (one) thousandth? *6.504* the nearest hundredth? *6.50***
   Write the rounded decimals for display. Point out that the zero in the hundredths place of 6.50 is necessary because the hundredths is the rounding place.
4. Direct the students to write 6.50367 on paper in fraction form (as a mixed number), word form, expanded form, and expanded form with multiplication. Choose students to write the forms for display. ***$6\frac{50,367}{100,000}$; six and fifty thousand three hundred sixty-seven hundred thousandths; 6 + 0.5 + 0.003 + 0.0006 + 0.00007; and (6 × 1) + (5 × 0.1) + (3 × 0.001) + (6 × 0.0001) + (7 × 0.00001)***
5. Repeat the activity (steps 3–4) with another decimal if needed.

Compare whole numbers and decimals

Select students to complete these number sentences and to explain the method they used to compare the numbers.

34,069,451 > 34,068,451 2.030 = 2.03
0.2181 < 0.51 0.467 > 0.01000
70,000,000 + 300,000 + 600 + 50 < 70,306,500
6 + 0.03 + 0.0004 < (6 × 1) + (3 × 0.01) + (4 × 0.001)

Apply addition properties and the Zero Principle of Subtraction

Write the following equations for display. Select students to identify and explain the property or the principle applied in each equation. For each equation, choose students to substitute whole numbers and decimals for the variables and to solve the equations.

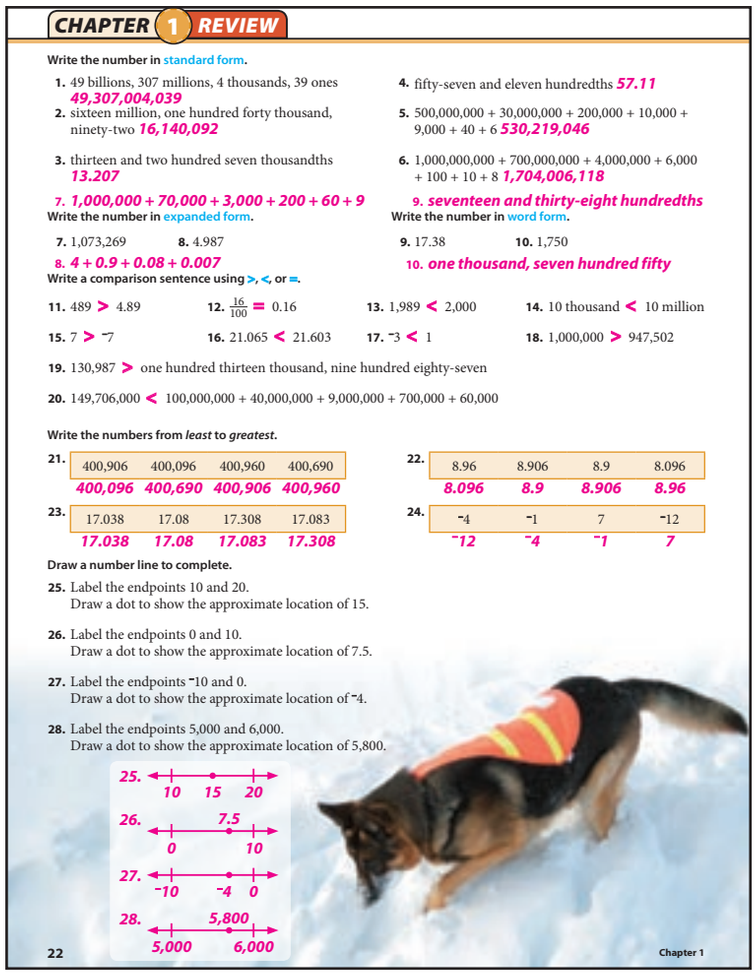
$a + 0 = a$ ***Identity Property of Addition***
$a - 0 = a$ ***Zero Principle of Subtraction***
$(a + b) + c = a + (b + c)$ ***Associative Property of Addition***
$a + b = b + a$ ***Commutative Property of Addition***

Estimate, solve, and check addition and subtraction problems

1. Direct the students to write the displayed addition and subtraction equations on paper, estimate each answer, and then solve for the exact answer. Remind them to carefully align the places when writing the problems. Discuss the problems, writing the answers to them as students give the answers. Use these questions to review the estimating, solving, and checking as needed.

   ➤ **What do you estimate the answer to be? Explain how you determined the estimate.**

   ➤ **What is your exact answer?**



CHAPTER 1 REVIEW

Write the number in standard form.

1. 49 billions, 307 millions, 4 thousands, 39 ones *49,307,004,039*
2. sixteen million, one hundred forty thousand, ninety-two *16,140,092*
3. thirteen and two hundred seven thousandths *13.207*
4. fifty-seven and eleven hundredths *57.11*
5. 500,000,000 + 30,000,000 + 200,000 + 10,000 + 9,000 + 40 + 6 *530,219,046*
6. 1,000,000,000 + 700,000,000 + 4,000,000 + 6,000 + 100 + 10 + 8 *1,704,006,118*
7. *1,000,000 + 70,000 + 3,000 + 200 + 60 + 9*
9. *seventeen and thirty-eight hundredths*

Write the number in expanded form.

7. 1,073,269
8. 4.987
8. *4 + 0.9 + 0.08 + 0.007*

Write the number in word form.

9. 17.38
10. 1,750
10. *one thousand, seven hundred fifty*

Write a comparison sentence using >, <, or =.

11. 489 > 4.89
12. $\frac{16}{100}$ = 0.16
13. 1,989 < 2,000
14. 10 thousand < 10 million
15. 7 > ⁻7
16. 21.065 < 21.603
17. ⁻3 < 1
18. 1,000,000 > 947,502
19. 130,987 > one hundred thirteen thousand, nine hundred eighty-seven
20. 149,706,000 < 100,000,000 + 40,000,000 + 9,000,000 + 700,000 + 60,000

Write the numbers from *least* to *greatest*.

21.				
	400,906	400,096	400,960	400,690
	400,096	*400,690*	*400,906*	*400,960*

22.				
	8.96	8.906	8.9	8.096
	8.096	*8.9*	*8.906*	*8.96*

23.				
	17.038	17.08	17.308	17.083
	17.038	*17.08*	*17.083*	*17.308*

24.				
	⁻4	⁻1	7	⁻12
	⁻12	*⁻4*	*⁻1*	*7*

Draw a number line to complete.

25. Label the endpoints 10 and 20. Draw a dot to show the approximate location of 15.
26. Label the endpoints 0 and 10. Draw a dot to show the approximate location of 7.5.
27. Label the endpoints ⁻10 and 0. Draw a dot to show the approximate location of ⁻4.
28. Label the endpoints 5,000 and 6,000. Draw a dot to show the approximate location of 5,800.

25. *10 15 20*
26. *7.5; 0 10*
27. *⁻10 ⁻4 0*
28. *5,800; 5,000 6,000*

Round to the greatest place to estimate the sum or difference.

29. 67,380 + 5,274 *75,000*
30. 22,003 − 13,675 *10,000*
31. 36.2 − 18.375 *20*

Estimate the sum or difference using front-end estimation.

32. 34,475 + 6,056 + 92,800 *132,000*
33. 802,000 − 317,876 *490,000*
34. 58.496 + 1.054 *59*

Solve.

35. 243,942 + 571,806 + 209,999 = *1,025,747*
36. $417.49 + $103.98 + $ 41.51 = *$562.98*
37. 500,000 − 17,943 = *482,057*
38. 49.039 − 19.467 = *29.572*
39. ⁻3 + ⁻2 = *⁻5*
40. 1 + ⁻4 = *⁻3*
41. 0 + ⁻6 = *⁻6*
42. ⁻5 + 7 = *2*

Use an addition property to complete the equation.

43. 478 + 29 = $\frac{?}{}$ + 478; *29*
44. 315 = $\frac{?}{}$ + 315; *0*
45. (81 + 71) + 60 = 81 + ($\frac{?}{}$ + 60); *71*

Follow the directions.

46. Write the places in order from *greatest* to *least*.
Hundred Thousand, Hundredth, Million, Tenth
Million, Hundred Thousand, Tenth, Hundredth
47. Do numbers *increase* or *decrease* in value as you move right on a number line? *increase*
48. Solve 1,495 − 738 = $\frac{?}{}$. Write an addition equation to check your answer. *757; 757 + 738 = 1,495*
49. Write 19, 53, 846, and 1,265 in Roman numerals. *19 = XIX; 53 = LIII; 846 = DCCCXLVI; 1,265 = MCCLXV*
50. Write two addition equations and two subtraction equations using 8, 12, and 20. *8 + 12 = 20; 12 + 8 = 20; 20 − 12 = 8; 20 − 8 = 12*
51. Round 11,564,298 to the nearest one million and the nearest ten thousand. *12,000,000; 11,560,000*
52. Draw a part-whole model for the equation *n* + 6.84 = 19.05. Solve. *19.05 − 6.84 = 12.21*
53. Write 278,946,384 in expanded form and word form. *200,000,000 + 70,000,000 + 8,000,000 + 900,000 + 40,000 + 6,000 + 300 + 80 + 4; two hundred seventy-eight million, nine hundred forty-six thousand, three hundred eighty-four*

Solve.

54. Eric spends 10 minutes each night, Monday through Friday, reviewing his math facts. He spends 30 minutes each week reviewing his spelling words. How much review time does Eric spend each week reviewing math and spelling? *Equations may vary. 10 + 10 + 10 + 10 + 10 + 30 = 80 minutes*
55. Kathleen read 3,922 pages for the summer reading program. She read 746 pages from mystery books, 1,347 pages from historical novels, and the rest came from biographies. How many pages of biographies did Kathleen read? *746 + 1,347 = 2,093; 3,922 − 2,093 = 1,829 pages*

52.

19.05	
n	*6.84*

➤ How does your exact answer compare to your estimate? Is it reasonable?
➤ How can you check the accuracy of your answer?

2. Instruct the students to check their answers to the subtraction problems using addition.

Use a part-whole model to solve word problems

Guide the students in using a part-whole model to solve these word problems. Follow a procedure similar to the one used in Lesson 6.

The morning attendance count at Faith Christian Academy was 365. Then some students went home early due to snow, so the attendance count dropped to 289. How many students went home early? *365 − n = 289; a part is missing; n = 365 − 289; n = 76 students*

Adam is on a mission trip to South America. He spent $65.39 for souvenirs during the first week. Adam has $109.61 left of the money he brought for souvenirs. How much souvenir money did Adam bring on the trip? *n = $65.39 + $109.61; the whole is missing; n = $175.00*

Renee is saving money for the purchase of a new bicycle that costs $154.99. She has $96.50 saved. How much more money does she need? *$96.50 + n = $154.99; a part is missing; n = $154.99 − $96.50; n = $58.49*

Read and write Roman numerals

➤ Why is the Roman numerical system referred to as an "Additive-Subtractive" system? *Elicit that instead of having unique numerals or symbols for each number, you add or subtract to make numbers.*

➤ What are the three main rules for writing Roman numerals? *A symbol or letter can be used or repeated only 3 times; when a lesser symbol comes after a greater symbol, you add the lesser symbol to the greater symbol; and when a lesser symbol comes before a greater symbol, you subtract the lesser symbol from the greater symbol.*

1. Lead in counting as the students list vertically on paper the Roman numerals for these numbers. Discuss the patterns and the rules used to write the Roman numerals.
   1–10 by 1s: *I, II, III, IV, V, VI, VII, VIII, IX, X*
   10–100 by 10s: *X, XX, XXX, XL, L, LX, LXX, LXXX, XC, C*
   100–1,000 by 100s: *C, CC, CCC, CD, D, DC, DCC, DCCC, CM, M*
2. Guide the students in using place value (expanded form) to write these Roman numerals.
   246 = *200 + 40 + 6; CC + XL + VI; CCXLVI*
   439 = *400 + 30 + 9; CD + XXX + IX; CDXXXIX*
   777 = *700 + 70 + 7; DCC + LXX + VII; DCCLXXVII*

Student Text pp. 22–23

Lesson 11 — **Student Text** pp. 24–27

Chapter 1 Test

Grade 5 Review

For a list of the skills reviewed in the Grade 5 Review, see the Lesson Objectives for Lesson 11 in the Chapter 1 Overview on page 2 of this Teacher's Edition.

Student Materials

- Cumulative Review Answer Sheet, page IA9 (CD)

Note

The Cumulative Review Answer Sheet has 25 answer lines; however, not all of the Cumulative Review Student Text pages have a total of 25 problems.

Use the Grade 5 Review on Student Text pages 24–26 to review concepts taught in fifth grade and to determine which students would benefit from your reteaching of the concepts. To prepare the students for the format of achievement tests, instruct them to work on a separate sheet of paper, if necessary, and to mark the answers on the Cumulative Review Answer Sheet.

Read aloud the Career Link on Student Text page 27 (page 25 of this Teacher's Edition) and discuss the value of math as it relates to a carpenter.

GRADE 5 REVIEW

Test Prep

Mark the answer.

1. $\begin{array}{r} 337 \\ +\,954 \end{array}$
   A. 1,283
   B. 1,291
   C. 623

2. $\begin{array}{r} 590{,}006 \\ -\,357{,}324 \end{array}$
   A. 231,692
   B. 131,782
   C. 232,682

3. $164 + n = 831$
   A. $n = 667$
   B. $n = 995$
   C. $n = 7$

4. $3.7 + 4.52 = \underline{?}$
   A. 8.22
   B. 489
   C. 822

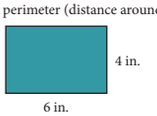
5. $57 \times 8 = \underline{?}$
   A. 406
   B. 456
   C. 449

6. $79 \times 10 = \underline{?}$
   A. 709
   B. 790
   C. 7,900

7. $8 \times n = 96$
   A. $n = 44$
   B. $n = 15$
   C. $n = 12$

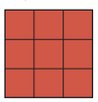
8. $37 \div 6 = \underline{?}$
   A. 21 r3
   B. 5 r7
   C. 6 r1

9. Find the perimeter (distance around).



   A. 20 in.
   B. 24 in.
   C. 10 in.

10. Find the area (number of square units).



   A. 6 ft^2
   B. 12 ft^2
   C. 9 ft^2

Mark the equation.

11. 43 students and 18 more students
   A. $43 \times 18 = 774$
   B. $43 + 18 = 61$
   C. $43 - 18 = 25$

12. 27 packs of gum with 5 sticks in each pack
   A. $27 \div 5 = 5$ r2
   B. $27 \times 5 = 135$
   C. $27 - 5 = 22$

13. 96 cookies distributed into packages of 12 cookies
   A. $96 \div 12 = 8$
   B. $96 \times 12 = 1{,}152$
   C. $96 + 12 = 108$

14. 26 band members with 3 members out sick
   A. $26 \div 3 = 8$ r2
   B. $26 + 3 = 29$
   C. $26 - 3 = 23$

15. 7 rows of 6 chairs
   A. $56 \div 8 = 7$
   B. $7 - 6 = 1$
   C. $7 \times 6 = 42$

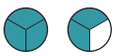
Mark the fraction or mixed number.

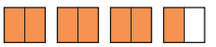
16. 
   A. $\frac{8}{11}$
   B. $\frac{2}{3}$
   C. $\frac{1}{6}$

17. 
   A. $\frac{5}{6}$
   B. $\frac{3}{9}$
   C. $\frac{1}{2}$

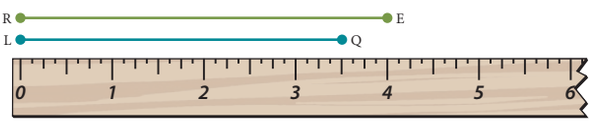
18. 

   A. $\frac{3}{5}$
   B. $\frac{4}{7}$
   C. $\frac{3}{4}$

19. 
   A. $\frac{12}{6}$
   B. $2\frac{1}{2}$
   C. $\frac{5}{3}$

20. 
   A. $\frac{7}{10}$
   B. $3\frac{1}{2}$
   C. $4\frac{1}{6}$

Mark the answer.



21. What is the length of $\overline{LQ}$?
   A. $3\frac{1}{3}$ in.
   B. $4\frac{1}{2}$ in.
   C. $3\frac{1}{2}$ in.

22. What is the length of $\overline{RE}$?
   A. $3\frac{3}{4}$ in.
   B. 4 in.
   C. 5 in.

23. $80{,}000 + 7{,}000 + 300 + 20 + 5 = \underline{?}$
   A. 87,305
   B. 87,325
   C. 873.5

24. $600 + 30 + 2 + 0.5 = \underline{?}$
   A. 632.5
   B. 6,325
   C. 63.25

25. $643{,}872 + 10{,}000 = \underline{?}$
   A. 653,872
   B. 743,872
   C. 643,873

CAREER LINK

Carpenter

A carpenter works on projects from simple home repairs to intricate woodwork in prestigious homes. Accurate measuring is important for saving time and money for the homeowner and the builder. A carpenter uses math in every project, starting with the planning stage and continuing throughout the entire building process until the project is complete.

A tape measure is one of a carpenter's most important tools. Converting inches and feet and using fractions are skills he uses every day. When he looks at a blueprint and reads the measurements of the rooms, he must account for the thickness of the walls, the size of the bathtub, the number of doors, and many other details. These calculations are important for ordering the correct amount of lumber, insulation, Sheetrock, trim, and even the number of nails needed for a job.

A carpenter also determines the cost of hiring a crew and calculates the number of days the job will take to complete. His estimates must be accurate. Then the homeowner is assured a fair price and the crew will be paid good wages. Jesus illustrated counting the cost of following Him by referring to a person who plans to build a tower and first takes the time to plan and count the cost. A Christian builder should try to be a good steward of the materials and money for each task the Lord gives him to do. He also should strive to do the finest job possible for the homeowner and for his testimony.