1 ADD & SUBTRACT

ONE MAN AGAINST THE FLAMES

Chicago, Illinois **October 9, 1871**

During the summer of 1871, only about 2 ½ 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.

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.

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

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

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

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?

6. Write the number with the least value in expanded form with multiplication.

Write the number in standard form.

7. 30 billions, 407 millions, 17 thousands, 603 ones

8. forty-five million, two hundred twenty thousand, three hundred seven

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

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

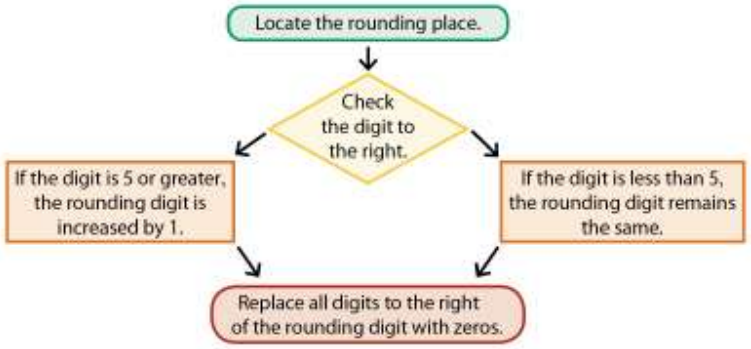
10. 14,625,902 ○ 5,986,597

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

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.

15. The value of each 5 in standard form

16. Round to the nearest one billion.

17. The value of 9 in standard form

18. Round to the nearest hundred thousand.

19. The digit in the Ten Thousands place

20. 568,932,000,000 is rounded to the nearest ?

21. The greatest place

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

22. 26,583 2,658 26,853 23,598

23. 703,567 703,765 703,675 703,766

Practice & Application

24. Write the number that is 1,000 *more than* 298,370.

25. Write the number that is 1,000 *less than* 6,581,257.

26. Write the standard form for 80,000,000 + 2,000,000 + 600,000 + 90,000 + 3,000 + 10.

27. Write 37,596,042 in word form.

28. Write the value of 8 in 608,396 in standard form.

29. Which two *ten thousands* is 81,960 between?

30. Round 15,058,296 to the nearest one million.

31. Round 351,798,200 to the greatest place.

32. Rearrange the digits in 21,034,065 to make the largest number possible. (Use all digits.)

33. Rearrange the digits in 21,034,065 to make the smallest number possible. (Use all digits.)

34. Write 106,000; 105,421; 105,986; and 105,682 from *least* to *greatest*.

J **Journal Entry:** Explain how adding commas to 17398052 helps you read the number.

Complete DAILY REVIEW 2 on page 402.

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 **2.** 143,688 + 81,704 **3.** 587,169 + 253,482 **4.** 3,945,100 + 1,069,388

Use front-end estimation to estimate the sum.

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

Add.

9. $\begin{array}{r} 139{,}728 \\ 403{,}680 \\ +\ 391{,}499 \\ \hline \end{array}$ **10.** $\begin{array}{r} 1{,}397{,}240 \\ 600{,}817 \\ +\ \ 129{,}007 \\ \hline \end{array}$ **11.** $\begin{array}{r} 14{,}659 \\ 72{,}019 \\ +\ 53{,}832 \\ \hline \end{array}$ **12.** $\begin{array}{r} 900{,}000{,}000 \\ 17{,}580{,}013 \\ +\ \ 395{,}602 \\ \hline \end{array}$

13. 15,642 + 1,389,420 **14.** 400,607 + 3,589 **15.** 136 + 49 + 210 + 108

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?

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?

18. Estimate the number of miles flown by Mr. Johnson and Mr. Brown.

19. Find the number of miles Mr. Johnson flew while making a round trip (flying to the meeting and then flying home).

Practice & Application

20. Add commas to 20043170.

21. Write the name of the greatest place in the number for problem 20.

22. Write 18,396,470,502 in expanded form.

23. Write *six hundred forty-nine thousand, five hundred seventeen* in standard form.

24. Write the value of 9 in 19,325,644 in word form.

25. Write two facts with a sum of 12 using different addends for each fact.

26. Find the sum of 94, 87, 57, and 19.

27. Find the sum of 903,871 and 89,532.

28. Write the number that is 1,000 *more than* 329,990.

29. Write a number sentence using the *greater than* symbol to compare the numbers 300,999 and 309,900.

30. Write 2,291,620; 2,291,206; 2,921,260; and 2,291,026 from *greatest* to *least*.

31. Round 1,398,750 to the nearest hundred thousand.

32. Round 7,521,024,308 to the greatest place.

33. Write the next eight numbers for the *count by 6* pattern: 6, 12, 18, 24.

Journal Entry: Estimate the sum of 158,341 and 211,977 by rounding to the greatest place.

Journal Entry: Estimate the sum of 158,341 and 211,977 by front-end estimation.

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.

Complete DAILY REVIEW b on page 402.

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.

Problem-Solving Plan
strategy
part-whole model
variable

- 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?

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

2.

15,000	
500	n

3.

120		
10	50	n

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

5. the cost of a bottle of water for $1.39 and a bottle of soda for $1.89

6. 2,013 tickets of 4,500 tickets have been sold

7. the change from $20 after purchasing sunglasses for $13.39

8. the length of the 100-foot towline remaining after 38.5 feet has been removed

9. 35 minutes spent looking at boats and equipment; 25 minutes spent watching water skiers

Solve.

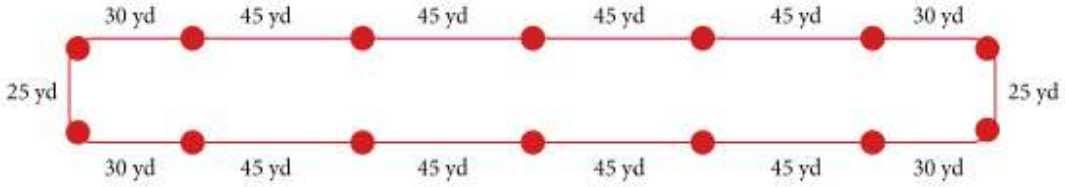
10. It will take Jay, Nathan, and Uncle Paul 2 hours to get to the water-skiing show. Nathan brought a 40-minute CD and a 75-minute CD. How many minutes short of 2 hours are the CDs?

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?

12. It costs \$1.25 extra for the shows. What will the total ticket price be if they each attend 2 shows?

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?

14. A water-skiing course is set up with buoys in the formation shown below. What is the perimeter of the course?



Practice & Application

15. Find the sum of 17,060 and 31,931,501.

16. Estimate the difference between 27,400 and 11,790 using front-end estimation.

17. Round the number to the nearest ten thousand.

1,576,284 84,970 360,483 9,642

18. Write 39,460; 39,466; 39,409; and 39,406 from *greatest* to *least*.

19. Write the largest three-digit whole number.

20. Write the smallest three-digit whole number.

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.

J **Journal Entry:** Explain how knowing that addition and subtraction are inverse operations can help you solve $89 + n = 165$.

Complete DAILY REVIEW on page 404.