

4 Grouping, Regrouping, and Place Value

Dear Student,

Why is it that 2 dimes and 4 pennies are 24 pennies, but **2 feet** and **4 inches** are not **24 inches**? You will explore questions like this one as you discuss different ways to group objects. These measurement units count things in different ways, so the amounts are written in different ways.

What about other measurement units you know?

How many days in **1 week**?

How many days in **2 weeks**?

SUN	MON	TUE	WED	THU	FRI	SAT

How many minutes in **1 hour**?

How many minutes in **3 hours**?



Mathematically yours,
The authors of *Think Math!*



The Grand Canyon

FACT • ACTIVITY 1

The Grand Canyon in northern Arizona was formed over millions of years as the Colorado River eroded away the land to make a deep gorge. Although the canyon is in a very dry area, many different kinds of wildlife live there.

For these problems, use base-ten blocks where a unit cube represents 1, a rod is 10, and a flat is 100.

Grand Canyon Wildlife	
Animal Life	Number of Species
Mammals	91
Reptiles and Amphibians	57
Fish	17
Birds	373

- Which base-ten blocks could you use to show the number of reptiles and amphibians?
- How many flats are needed to show the number of bird species?
- How could you use base-ten blocks to help you find the total number of mammals and fish?
- Find the sum of the fish and bird species.



FACT • ACTIVITY 2

The Grand Canyon area was established as a National Park in 1919. Millions of people visit the park every year. Visitors can hike trails, take mule trips, and camp in family campgrounds.

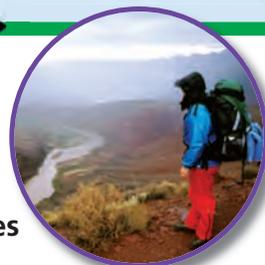
Write the number being described. Then write the Grand Canyon fact on this page that it represents.

- 1 My tens digit is 3. I tell a number of miles.
- 2 I am a number greater than 50 that has a ones digit that is 5 less than my tens digit.
- 3 I am greater than the number of miles of roads and less than the number of miles of trails.
- 4 My word name has "two hundred" in it, but I am greater than 300.
- 5 If you add 200 to me and increase my ones digit by 1, you will get another number in the facts. Name both numbers and facts.

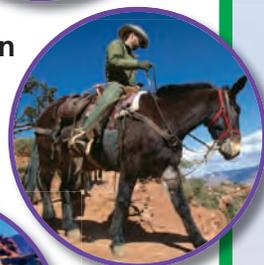
CHAPTER PROJECT

On a trip to the Grand Canyon, you buy a postcard for \$1.00 to send to your friend. You use only coins for your purchase. You use at least one of each coin (quarters, dimes, nickels, and pennies) to purchase the card.

- Make a table to show what coins you could use to purchase the postcard. Include at least 4 combinations.
- Which of your combinations uses the least number of coins?



630 miles of trails



mule trip riders in one year, South Rim, Plateau Point: 5,228



284 miles of roads

Family Campsites

Name of Campground	Number of Campsites
Mather	314
Desert View	50
North Rim	83
Tuweep	12



Grand Canyon National Park

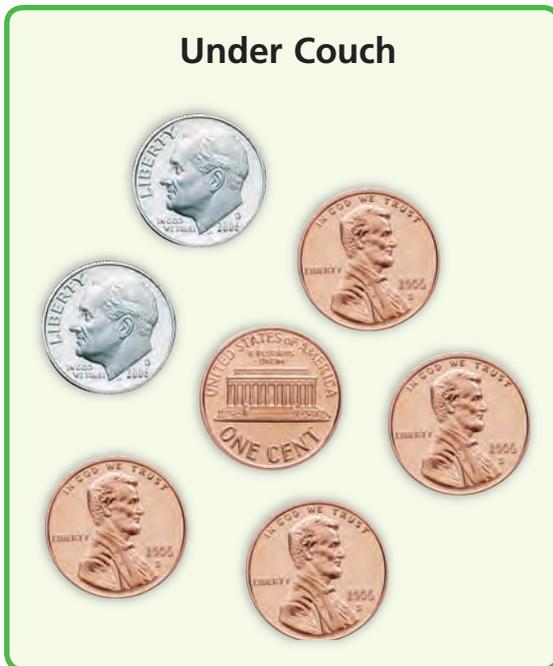
ALMANAC Fact

On the average, the walls of the Grand Canyon rise about 1 mile above the Colorado River.

EXPLORE

Combining and Removing Coins

- 1 Ari found 2 dimes and 5 pennies under the couch. Then he found 1 dime and 8 pennies in his pocket.



His mother traded coins with him so he had the same amount in fewer coins, but still had only dimes and pennies. How many dimes and pennies did he have?

- 2 Esta had 4 dimes and 3 pennies.



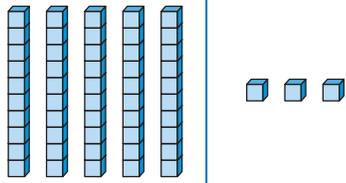
She bought something that cost 2 dimes and 6 pennies. If she has only dimes and pennies and the fewest coins, how much does she have left?

REVIEW MODEL

Using Base-Ten Blocks

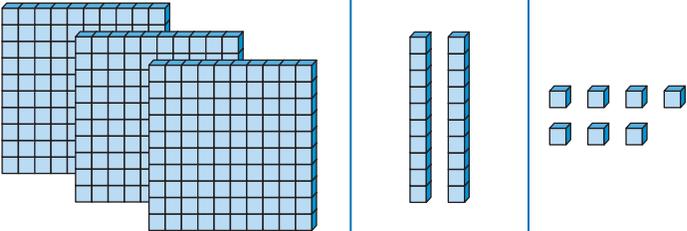
You can use base-ten blocks to represent a number.

Example A

	
Tens	Ones
5	3
5 tens	3 ones

$$50 + 3 = 53$$

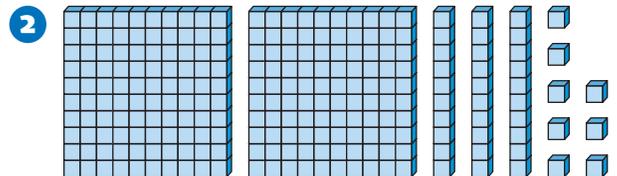
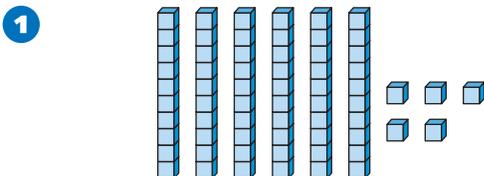
Example B

		
Hundreds	Tens	Ones
3	2	7
3 hundred	2 tens	7 ones

$$300 + 20 + 7 = 327$$

✓ Check for Understanding

Write the number.



- 3 Use pictures, numbers, or words to tell how you would represent 419 using base-ten blocks.

EXPLORE

Listing Possible Numbers

Who am I?

Clue A: I am greater than 4×11 and less than 5×11 .

Clue B: $u < t$

Clue C: I am odd.

Clue D: A group of 6 base-ten blocks matches me.

Mrs. Jackson loved to invent puzzles for her class.

One student guessed that the t stood for tens. Mrs. Jackson used u to stand for units, because she thought o (for ones) looked too much like the digit 0.

- 1 Make a list of the numbers that match **Clue A**.

- 2 A student noticed that **Clue B** eliminates 45. What numbers can you cross off the list because they do not fit **Clue B**?

- 3 What numbers are still on the list?

- 4 What numbers can you cross off the list because they do not fit **Clue C**?

- 5 What numbers are still on the list?

- 6 What is the mystery number?

EXPLORE

Considering Digits

The class looked at the first clue in this puzzle. Someone said there were too many numbers to list. So, the class decided to list the possible units and tens digits, and then cross out the digits that did not fit the clues.

A student wrote this list on the board:

<i>t</i>	<i>u</i>
	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

Who Am I?

Clue A: I am odd.

Clue B: I can be made with 13 base-ten blocks.

Clue C: $t > u$

1 Why didn't the student write a 0 in the tens column?

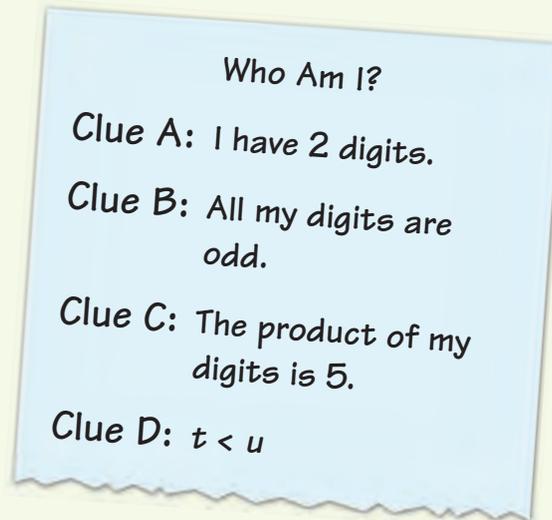
2 What is the mystery number?

EXPLORE

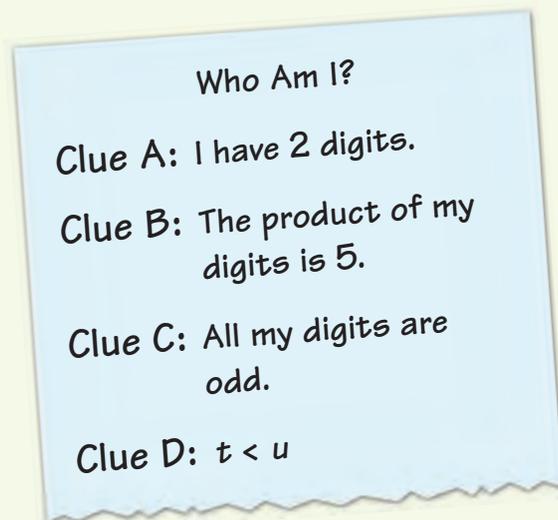
Ordering Clues

Does the order of clues change how you solve a puzzle?

- 1 To find the mystery number, use the clues in order.



- 2 Now try using the clues in this order. How is your reasoning different?



REVIEW MODEL

Using a Place-Value Chart

You can use a place-value chart to help you understand each digit in a number.

Example A

There were 29,460 people at the candidate's speech.

Ten Thousands	Thousands	Hundreds	Tens	Ones
2	9	4	6	0

Find the value of the digit 9: 9,000.

Name the number using words: twenty-nine thousand, four hundred sixty.

Example B

The candidate won the election by 852,641 votes.

Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
8	5	2	6	4	1

Find the value of the digit 5: 50,000.

Name the number using words: eight hundred fifty-two thousand, six hundred forty-one.

✓ Check for Understanding

Write the value of the blue digit.

1 9,486

2 309,421

3 418,237

Write the number.

4 five thousand,
eight hundred forty

5 sixty thousand

6 two hundred thirty-
one thousand,
seven hundred
fifty-six

REVIEW MODEL

Problem Solving Strategy

Make an Organized List

How many ways can you arrange the digits 4, 5, and 6 to make a three-digit number?

Strategy: Make an Organized List

Read to Understand

What do you know from reading the problem?

I need to find all the ways to arrange the digits 4, 5, and 6 to make a three-digit number.

Plan

How can you solve the problem?

You can make an organized list.

Solve

How can you make an organized list?

List the three-digit numbers with a 4 in the hundreds place and 5 or 6 in the tens and ones places.

Then list the numbers with a 5 in the hundreds place and 4 or 6 in the tens and ones places.

Finally, list the numbers with a 6 in the hundreds place and 4 or 5 in the tens and ones places.

The list shows 4, 5, and 6 can be arranged in 6 different ways.

H	T	O
4	5	6
4	6	5
5	4	6
5	6	4
6	4	5
6	5	4

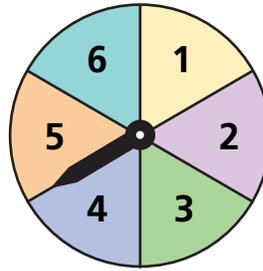
Check

Look back at the problem. Did you answer the question that was asked? Does the answer make sense?

Problem Solving Practice

Use the strategy *make an organized list* to solve.

- 1 What is the two-digit mystery number?
 - A. I am greater than 9×9 .
 - B. I am an odd number.
 - C. My tens digit is 2 more than my ones digit.
- 2 Simon and Lily used the spinner shown at right. They spun the pointer and recorded their results. Their results were 6, 5, 6, 4, 1, 2, 1, 3, 5, 6, 2, 3, 6, 4, and 2. Which number occurred most often?



Problem Solving Strategies

- ✓ Act It Out
- ✓ Draw a Picture
- ✓ Guess and Check
- ✓ Look for a Pattern
- ✓ Make a Graph
- ✓ Make a Model
- ✓ **Make an Organized List**
- ✓ Make a Table
- ✓ Solve a Simpler Problem
- ✓ Use Logical Reasoning
- ✓ Work Backward
- ✓ Write a Number Sentence

Mixed Strategy Practice

Use any strategy to solve. Explain.

- 3 Javier and Nina are playing a game. Javier has 8 cards and picks up 5 cards. Nina has 6 cards. How many more cards does Nina need to have the same number as Javier?
- 4 Janelle spent 2 weeks and 1 day at camp. She spent 1 week and 5 days visiting her grandmother. How many days was Janelle away?
- 5 Jim hiked the first 3 miles of the trail in 1 hour. If he continues at the same pace, how many miles will he hike in 4 hours?
- 6 Olga is choosing a writing tool and a paper color for her journal. She can choose a pencil, a pen, a crayon, or a marker. She can choose white or yellow paper. What are all the different combinations of a writing tool and paper Olga can choose?

Choose the best vocabulary term from Word List A for each sentence.

- 1 Suppose you combine groups of tens and ones. You can ___?___ them to find the fewest units.
- 2 The place between the thousands place and the tens place is the ___?___ place.
- 3 The ___?___ in the tens place of 947 is 4.
- 4 You have three piles of coins. They are 6 nickels, 8 dimes, and 9 pennies. The pile with the ___?___ is 6 nickels.
- 5 To solve a mystery number puzzle, make a list and ___?___ possibilities using the clues.
- 6 When you ___?___ 8,925 to the nearest thousand, you get 9,000.

Complete each analogy. Use the best term from Word List B.

- 7 Cent is to dollar as ___?___ is to hundreds.
- 8 Letter is to word as ___?___ is to number.

Word List A

digit
eliminate
fewest units
hundreds
millions
number
regroup
round
smallest units
ten thousand
tens
thousands

Word List B

digit
ones
trade
unit

Talk Math

Discuss with a partner what you have learned about place value. Use the vocabulary terms *digit*, *thousands*, *hundreds*, *tens*, and *ones*.

- 9 How can you round a number to the nearest thousands place?
- 10 How can you use base-ten blocks to represent a four-digit number?

Analysis Chart

- 11 Create an analysis chart for the place-value terms *hundreds*, *millions*, *ten thousands*, and *thousands*.

Word Web

- 12 Create a word web using the word *round*. Use what you know about the different meanings of *round*.

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graph TD; A[ ] --- B[ ]; A --- C[ ]; A --- D[ ]; A --- E[ ]
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What's in a Word?



MILLION The English word *million* comes from the old Italian word *millione*. It was first used in the 1300s. *Milla* means "thousand." The suffix "-one" means "great." So, *millione* means "a great thousand."

Suppose the word *million* had not been created. We would have to call the millions place the *thousand-thousands place*. Then the ten-millions place would become the *ten-thousand-thousands place*. Number names would be very long and too confusing to use.



Technology

Multimedia Math Glossary

www.harcourtschool.com/thinkmath

GAME

Trading to 1,000

Game Purpose

To use base-ten blocks to represent sums

Materials

- 2 number cubes labeled 1–6
- Base-ten blocks (units, rods, flats, 1 large cube)
- Activity Master 35: Trading to 1,000



How To Play The Game

- 1** Play this game with a partner. Each player will need Activity Master 35. Decide who will play first.
- 2** The first player tosses both number cubes.
 - Write the numbers under Toss A and Toss B on Activity Master 35.
 - Use the tossed numbers to make a two-digit number. Write it under Chosen Number in the table.
 - Show your chosen number with base-ten blocks. Combine them with the blocks from your previous total. (There is nothing to combine on your first toss.)
 - Write an addition sentence for the combined base-ten blocks in the last column.
- 3** Players take turns. The first player to trade 10 flats for the large cube wins!

GAME

Place Value Game

Game Purpose

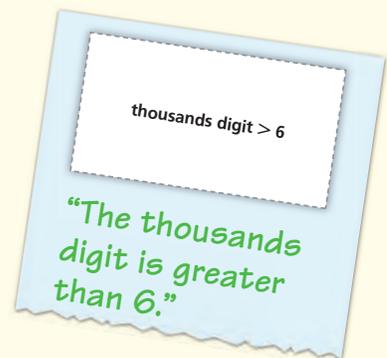
To practice identifying place-value attributes

Materials

- Activity Masters 36–46: Attribute Cards, Sets A–C
- scissors

How to Play the Game

- 1** Play this game with a small group. Cut out the Attribute Cards. There are three sets of cards. Choose the set (or sets) you want to use.
 - Set A cards have the easiest clues.
 - Set B cards have more difficult clues.
 - Set C cards have the most difficult clues.
- 2** Each player writes 5 four-digit numbers on a sheet of paper. Write neatly and large enough for others to see.
- 3** Place the Attribute Cards face down. Take turns turning over an Attribute Card and reading it aloud. All players cross out any of their numbers that match that attribute.
- 4** Play until someone crosses out all 5 numbers. That person wins!
Example: A player turns over this card:
Your numbers are 1,409; 7,246; 2,030; 8,925; 5,634.
You can cross out 7,246 and 8,925.
- 5** Play as many games as you can in the time allowed.



CHALLENGE

In 1858, units of money in the United States were different from those we use today. There were five units—mill, cent, dime, dollar, and eagle. The chart shows how much each unit was worth and its symbol.

United States Money in 1858	
10 mills (m.)	= 1 cent (c.)
10 cents (c.)	= 1 dime (d.)
10 dimes (d.)	= 1 dollar (\$)
10 dollars (\$)	= 1 eagle (E)

Use the chart to answer the questions below. They come from a math textbook that was used by students in 1858!

- 1 How many mills in 2 cents?
- 2 How many cents in 3 dimes?
- 3 How many dimes in 4 dollars?
- 4 How many dollars in 2 eagles?
- 5 How many dimes in 1 eagle?
- 6 How many dimes in 3 dollars and 6 dimes?
- 7 How many cents in 4 dimes and 7 cents?
- 8 How many dimes are equal to 70 cents?
- 9 If James earned 12 dollars and his father earned 3 eagles, how many dollars did they earn together?
- 10 A man has 4 eagles, 4 dollars, and 4 dimes. How many dollars and cents does he have?