

3 Using Addition and Subtraction

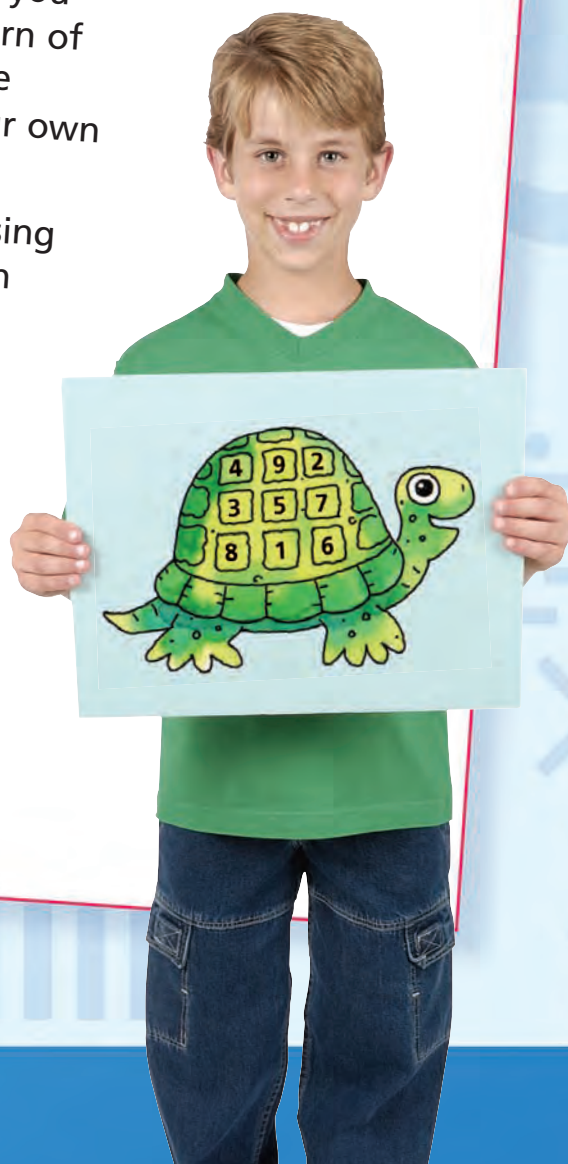
Dear Student,

In Chinese legend, a curious pattern of numbers was once found on the back of a turtle shell. People have been studying the mystery of these numbers for centuries.

This arrangement of numbers has certain properties, so people began to call it a magic square. Do you know what makes the pattern of numbers in the magic square special? Could you make your own magic square?

In this chapter, you will be using your addition and subtraction skills to solve interesting questions and puzzles like the magic square. You will work with money, and you'll also learn about reading graphs similar to the graphs scientists use to see patterns.

Mathematically yours,
The authors of ***Think Math!***



Tropical Fruits

Most of us are familiar with at least two types of tropical fruit: pineapples and bananas. However, there are many other fruits that grow in tropical regions.

FACT • ACTIVITY 1

The durian is known as the “King of Fruits” in parts of Southeast Asia. It is a very popular tropical fruit found mainly in Malaysia, Indonesia, and Thailand. Durians are either round or oval in shape and covered with hard spikes. Some people love the melons, but others don’t because the fruit has a very strong smell.



Answer the following questions. Use the data in the Almanac Fact for Problems 2 and 3.

- 1 If you buy three durians weighing 5 pounds, 10 pounds, and 8 pounds, what is the total weight of the melons?
- 2 Suppose a young durian tree bears only 10–50 melons. How old could the durian tree be?
- 3 If a durian tree is 11 years old, how many more years will the tree need to grow before it can produce more than 100 melons?



A tropical fruit salad is a great way to enjoy a variety of fruits. Three different mixed tropical fruit salads are shown below. To set the price of each salad, the chef first sets a price for each kind of fruit used in the salads. The price of the salad is the sum of the prices for the fruits used in the salad.



FACT • ACTIVITY 2

Answer the questions based on the prices given.

Fruit Salad 1:
Watermelon,
Star Fruit,
Pineapple

Fruit Salad 2:
Mango,
Papaya,
Pineapple

Fruit Salad 3:
Jambu, Guava,
Watermelon,
Pineapple

- 1 What is the price of Fruit Salad 1?
- 2 If you pay for Fruit Salad 2 with 3 quarters, how much change should you receive? Explain.
- 3 What is the fewest number of coins you could use to buy Fruit Salad 3? Explain.

Price of Tropical Fruits per Serving

Tropical Fruit	Price
Jambu (water apple)	3¢
Pineapple	5¢
Star Fruit	10¢
Guava	15¢
Watermelon	20¢
Papaya	25¢
Mango	30¢
Strawberries	35¢
Kiwi	40¢

CHAPTER PROJECT

Materials: paper, markers or colored pencils

Create a menu with 3 different tropical fruit salads. Use the list of fruits and prices from Fact Activity 2. You may use no more than 5 fruits in your salad. Each fruit salad must cost a total of 99 cents or less.

- Name your salads.
- List the ingredients of your salad.
- Calculate the total price of each salad on your menu.
- List the fewest coins needed to equal the price of the salad.

ALMANAC Fact

It takes about 6 years for a durian tree to bear fruit. Trees older than 10 years can bear 50-100 melons a year. Twenty-year-old trees can bear 100-200 melons.

REVIEW MODEL

What Is a Magic Square?

In a magic square like this one, every row, column, and diagonal has the same sum.

7	17	3
5	9	13
15	1	11

$$7 + 17 + 3 = 27$$

$$5 + 9 + 13 = 27$$

$$15 + 1 + 11 = 27$$

$$7 + 5 + 15 = 27$$

$$17 + 9 + 1 = 27$$

$$3 + 13 + 11 = 27$$

$$7 + 9 + 11 = 27$$

$$15 + 9 + 3 = 27$$

✓ Check for Understanding

- 1 If one row has a different sum than the others, is the array a magic square? Explain.

- 2 If you changed one of the numbers in this magic square to an even number, would it still be a magic square? Explain.

EXPLORE

Magic Squares with Missing Addends

Fill in the blanks so that each row, column, and diagonal in the magic square has the same sum.

5	■	11
■	14	■
■	■	23

- 1 What is the special sum for this magic square?
How do you know?

11	■	5
■	14	■
■	■	17

- 2 What is the special sum for this magic square?
How do you know?

- 3 Describe any relationships you see between the two completed magic squares.

EXPLORE

Exploring Odd
and Even Numbers

Jackie had some marbles and two boxes—one blue box and one green box. Jackie put all the marbles in the two boxes.

What can you say about this situation?

Write whether each statement is *true* or *false*.

Statement 1

If Jackie started with an even number of marbles, then she **must** have put the same number in each box.

Statement 2

If Jackie started with an even number of marbles, then she **could** have put the same number in each box.

Statement 3

If Jackie started with an odd number of marbles, then she **could not** have put the same number in each box.

Statement 4

If Jackie put the same number of marbles in each box, then the total number of marbles **must** have been even.

Statement 5

If Jackie put a different number of marbles in each box, then the total number of marbles **must** have been odd.

REVIEW MODEL

Exchanging Coins

You can practice regrouping by exchanging coins to find the fewest coins for a given amount.

Activity Use quarters, dimes, nickels, and pennies to make 72¢. When possible, exchange for coins of greater value to find the fewest coins for 72¢.

Step 1

Look at the collection of coins. Is the amount made with the fewest coins?



The amount is not made with the fewest coins, because you can exchange some pennies for another nickel.

Step 2

Exchange 5 pennies for 1 nickel.



Can another exchange be made?

Step 3

Exchange 2 nickels for 1 dime.



No more exchanges can be made. So, the collection has the fewest coins possible for 72¢.

✓ Check for Understanding

Show how to make the same amount using the fewest coins. Use quarters, dimes, nickels, and pennies.

1



2



3



EXPLORE

Eliminating Possibilities

When taking tests, you can use estimation to eliminate wrong answer choices.

Problem	Without calculating, quickly choose one answer that you are sure is wrong. Explain what makes you sure.	Without looking at any of the possible answers, make a quick estimate.	Choose the answer.
1 $\begin{array}{r} 56 \\ + 47 \\ \hline \end{array}$ A. 9 B. 32 C. 93 D. 103		Estimate:	A. 9 B. 32 C. 93 D. 103
2 $\begin{array}{r} 47 \\ - 38 \\ \hline \end{array}$ A. 9 B. 19 C. 75 D. 85		Estimate:	A. 9 B. 19 C. 75 D. 85
3 $\begin{array}{r} 83 \\ - 48 \\ \hline \end{array}$ A. 21 B. 35 C. 45 D. 131		Estimate:	A. 21 B. 35 C. 45 D. 131
4 $\begin{array}{r} 736 \\ + 264 \\ \hline \end{array}$ A. 532 B. 900 C. 990 D. 1,000		Estimate:	A. 532 B. 900 C. 990 D. 1,000

Hint . . . You may want to write something like, "about 1,000," or "between 900 and 1,100."

REVIEW MODEL

Estimating Sums and Differences

You can estimate sums and differences by using various methods.

Estimate $32 + 29$.

One Way**Step 1**

Use the digit in the greatest place-value position to approximate each number.

$$\begin{array}{r} 32 + 29 \\ 30 + 20 = 50 \end{array}$$

Step 2

Get a closer estimate by seeing if the digit in the next greatest place-value position will have an effect.

$$\begin{array}{r} 32 + 29 \\ 2 + 9 \text{ will make another } 10. \\ 30 + 20 = 50 \text{ and } 50 + 10 = 60 \end{array}$$

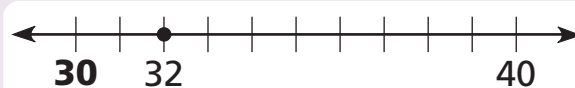
So, the sum is about 60.

Another Way

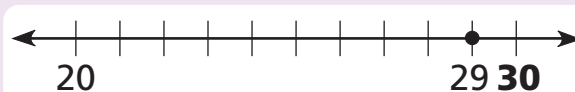
Use the closest multiples of 10.

$$32 + 29$$

The closest multiple of 10 for 32 is 30.



The closest multiple of 10 for 29 is 30.



$$30 + 30 = 60$$

So, the sum is about 60.

✓ Check for Understanding

Estimate the sum or difference. Choose any method.

1

$$\begin{array}{r} 43 \\ + 28 \\ \hline \end{array}$$

2

$$\begin{array}{r} 84 \\ - 66 \\ \hline \end{array}$$

3

$$\begin{array}{r} 602 \\ + 275 \\ \hline \end{array}$$

REVIEW MODEL

Problem Solving Strategy
Work Backward

Antonio has some nickels in his pocket.
He puts 4 dimes in his pocket. Now he has 65¢.
How many nickels does Antonio have?

**Strategy:** Work Backward**Read to Understand**

What do you know from reading the problem?

When Antonio put 4 dimes in his pocket he had 65¢.

What do you need to find out?

The number of nickels Antonio has.

Plan

How can you solve the problem?

You can work backward.

Solve

How can you work backward to solve the problem?

Start with the total amount Antonio has: 65¢.
Subtract 40¢ for the 4 dimes he put in his pocket:
 $65¢ - 40¢ = 25¢$. The difference of 25¢ represents the value of the nickels in his pocket. So, Antonio has 5 nickels.

Check

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

Problem Solving Practice

Work backward to solve.

- 1 Ty has 18 marbles. Wes has 12 more marbles than Zach. Zach has the same number of marbles as Ty. How many marbles does Wes have?
- 2 Before going to the 2:45 P.M. movie, you need to practice the piano for 1 hour and then clean your room for 15 minutes. Allow 30 minutes to walk to the theater. What is the latest time you could begin piano practice and still get to the movie on time?

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 On the first day of your 5-day vacation, you collect 25 shells. You collect 20 on the second day, 16 on the third day, and 13 on the fourth day. If the pattern continues, how many shells will you collect on the fifth day?
- 4 Today's lunch menu lists turkey and roast beef. The vegetable choices are carrots, green beans, or broccoli. How many different choices of one meat and one vegetable are there?
- 5 Ice cream costs 50¢. Jackson has 2 quarters, 2 dimes, and 3 nickels. Find all the ways he can use his coins to pay for the ice cream with the exact amount.
- 6 Jennifer bought a cap and shirt and spent \$27. The shirt cost twice as much as the cap. What was the cost of each item?

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

- 1 A(n) ? describes a number that is close to an exact amount.
- 2 A horizontal line on a grid makes a(n) ? with a vertical line.
- 3 You get two coins when you ? a dime for nickels.
- 4 There are 4 different coin ? that make 11¢.
- 5 The ? of two dimes is 20¢.
- 6 If you ? do something, then you are required to do it.
- 7 A(n) ? number of marbles can be divided equally between two girls.

Word List A

addition
sentence
amount
arrangement
array
combinations
could
estimate
even
exchange
intersection
must
odd
reflection
regroup
subtraction
sentence
value

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

- 8 Greatest is to most as ? is to least.
- 9 Sum is to addition as ? is to subtraction.

Word List B

difference
fewest
greatest
most
sum

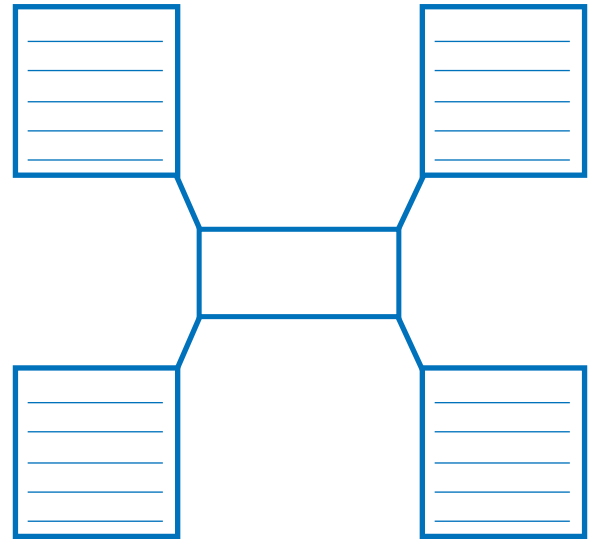
Talk Math

Discuss with a partner what you have learned about magic squares. Use the vocabulary terms *sum*, *column*, *row*, and *diagonal*.

- 10 How can you describe a magic square?
- 11 How can you prove that a magic square is really a magic square?

Word Web

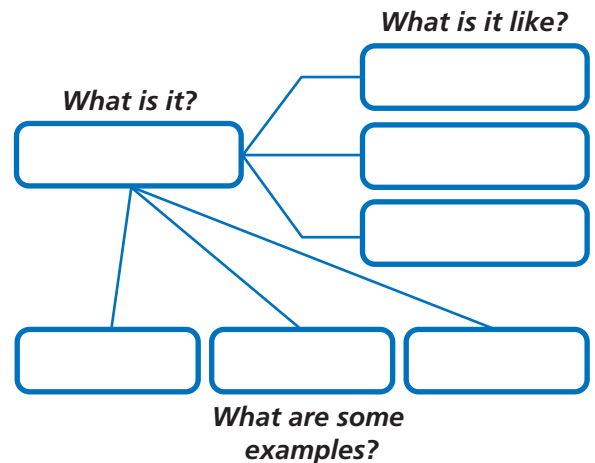
- 12 Create a word web for the term **reflection**. Use what you have learned about reflections of magic squares.



Word Definition Map

- 13 Create a word definition map for the term **intersection**.

- A What is it?
- B What is it like?
- C What are some examples?



MAGIC SQUARE Magic squares have been around for at least 3,000 years. The Chinese are the first people known to have made them. Not all magic squares have 3 rows and 3 columns. Benjamin Franklin was a famous American who loved magic squares. When he was a boy, he made one with 8 rows and 8 columns. Then a friend showed him a magic square with 16 rows and 16 columns. In a magic square, the number of columns must be the same as the number of rows. Also, the sum of each row, column, and diagonal must be equal.



Technology

Multimedia Math Glossary

www.harcourtschool.com/thinkmath

GAME

What Are My Coins?

Game Purpose

To practice finding the value of a group of coins

Materials

- A collection of real or play coins: pennies, nickels, dimes, and quarters

How to Play the Game

- 1** Play this game with a partner. Choose about 10 coins. Place them on the table between you. Then toss a coin to decide who plays first. The first player is the Hider. The second player is the Guesser.
- 2** While the Guesser looks away, the Hider takes some of the coins, finds their value, and hides them.
- 3** The Guesser asks *yes or no* questions to figure out which coins are hidden.

Examples:

- Are any of the coins pennies?
- Are the coins worth more than 20¢?
- Do you have more than three different coins?

- 4** When the Guesser has named the hidden coins and their total value, players switch roles. Put the hidden coins back on the table and play again.



GAME

Least to Greatest

Game Purpose

To practice estimating sums and differences

Materials

- Activity Masters 33 and 34: *Least to Greatest Cards*
- Stopwatch or clock with a second hand

How to Play the Game

- 1 Cut out the Least to Greatest cards from Activity Masters 33 and 34. Mix up the cards. Put them in a pile face down.
- 2 Play this game with a partner. One player is the Placer. The other player is the Timer. The Timer times the Placer for 60 seconds with a stopwatch or the second hand on a clock.
- 3 The Timer says "Go." The Placer turns over the cards one at a time. The goal is to place as many cards as possible in order from the smallest sum or difference to the largest. The Placer can pass on any card by setting it aside.
- 4 The Timer says "Stop" at 60 seconds and checks the order of the cards. The Timer tells the Placer if there are any mistakes. The Timer does not say what the mistakes are.
- 5 The Placer can try to correct the order of the cards. The Placer can even remove cards. When both players agree that the order is correct, the Placer gets 1 point for each card.

Example: These four cards are placed correctly.

$\begin{array}{r} 19 \\ -13 \\ \hline \end{array}$	$\begin{array}{r} 46 \\ -29 \\ \hline \end{array}$	$\begin{array}{r} 47 \\ -23 \\ \hline \end{array}$	$\begin{array}{r} 16 \\ +17 \\ \hline \end{array}$
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- 6 Switch roles. Play until time is called. The player with more points wins the game.

CHALLENGE

You can start with one magic square and change it to another. Complete the first problem below. Use that result to help you look for a pattern in the other magic squares. Can you predict the sum for each new magic square?

- ❶ Find the sum of this magic square.

15	18	3
0	12	24
21	6	9

For a new magic square, add 2 to each number.

A I predict that the sum of the new magic square will be ■.

B Draw the new magic square. What is the sum?

- ❷ Find the sum of this magic square.

17	32	29
38	26	14
23	20	35

For a new magic square, subtract 4 from each number.

A I predict that the sum of the new magic square will be ■.

B Draw the new magic square. What is the sum?

- ❸ Find the sum of this magic square.

9	2	7
4	6	8
5	10	3

For a new magic square, multiply each number by 2.

A I predict that the sum of the new magic square will be ■.

B Draw the new magic square. What is the sum?