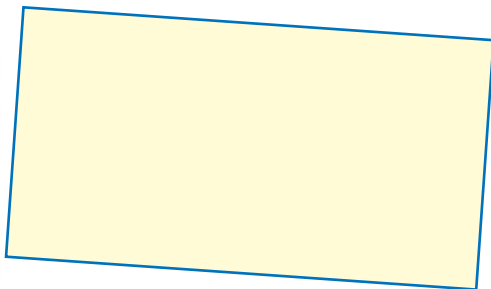


7 Fractions

Dear Student,

You have seen fractions in many places: when you need one third of a cup of flour, when it's half an hour until lunch, and when you buy something with a quarter (one fourth of a dollar). In this chapter, you will not only look at fractions and what they mean, but you will also compare fractions and develop strategies for thinking about them.

An important idea about fractions is they are made by cutting a whole into equal parts. How could you cut this rectangle into halves (2 pieces with the same area)? How could you cut this rectangle into 3 pieces with the same area?



There are many ways to cut a rectangle into halves and thirds, so be creative!

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



Paper Folding Fun

FACT • ACTIVITY 1

Origami is a Japanese word that means “paper folding.” There are 6 basic folds in origami: the mountain fold, valley fold, diagonal fold, fold and unfold, rotate, and flip over. These basic folds are used to create complex origami designs.

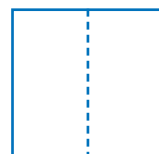


The models on the right show some folds that create fractional parts. Use these models for Problems 1–4.

- 1 What fractional parts are shown in Model A?
- 2 What fraction describes 3 of the equal parts in Model B?
- 3 How can you fold Model C to show fourths? Explore by folding a piece of square paper. Unfold your paper to show your folds. Draw a picture to show your answer.
- 4 Fold Model C into eighths. Show a fraction that is equivalent to your answer in Problem 2 by coloring some of the folded parts.



A



B



C

FACT • ACTIVITY 2



Imagine you are making origami designs to sell at the school arts and crafts fair. The table shows the time it takes to make each design and how much each design will cost.

Use a clock or coins for help.

- 1 Write each time in the table as a fraction of an hour.
- 2 Write each price in the table as a fraction of a dollar.

Origami Designs

Item	Time (minutes)	Price
bookmark	15	25¢
crane	10	30¢
coaster	20	50¢
frog	30	75¢



CHAPTER PROJECT

You can make more colorful origami by decorating the paper. Start with 2 pieces of white square paper. Fold each paper into 8 equal parts.

- On the first paper, create an interesting origami square by coloring one of the sections. Repeat the design on a number of sections so that your colored sections cover less than $\frac{5}{8}$ but more than $\frac{1}{4}$ of the paper.
- On the second paper, use three different colors on different sections of the square. Only use one color in each section. Write a fraction to show what part of the square each color represents.
- Use the papers you designed and fold each one into an object.

ALMANAC

Fact

The world's largest origami crane was created in Japan to promote world peace. The crane was 120 feet tall. About 10,000 children from all over the world helped to create drawings on the paper.

REVIEW MODEL

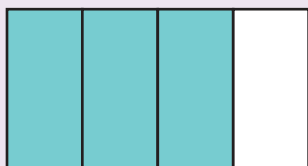
Understanding Fractions

A fraction names a part of a whole.

The number below the line tells how many equal-size pieces the whole was cut into.

The number above the line tells how many of those pieces you are referring to.

Example What fraction of the rectangle is shaded?



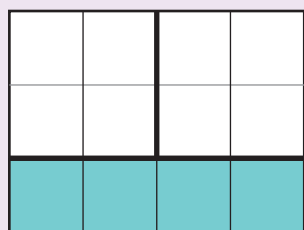
3 ← number of pieces shaded

4 ← number of equal-size pieces the whole was cut into

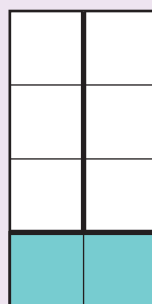
The **size** of each piece must be the same.

The **shape** of each piece does NOT have to be the same.

Examples



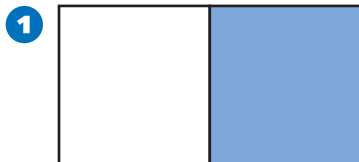
$\frac{1}{3}$ is shaded.



The shaded part is NOT $\frac{1}{3}$.

✓ Check for Understanding

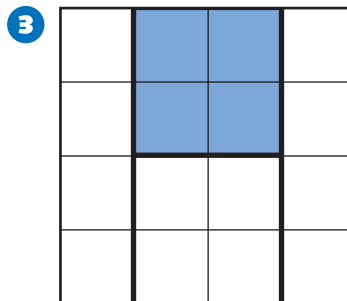
Write **yes** or **no** to answer the question.



Is $\frac{1}{2}$ shaded?



Is $\frac{2}{3}$ shaded?



Is $\frac{1}{4}$ shaded?

REVIEW MODEL

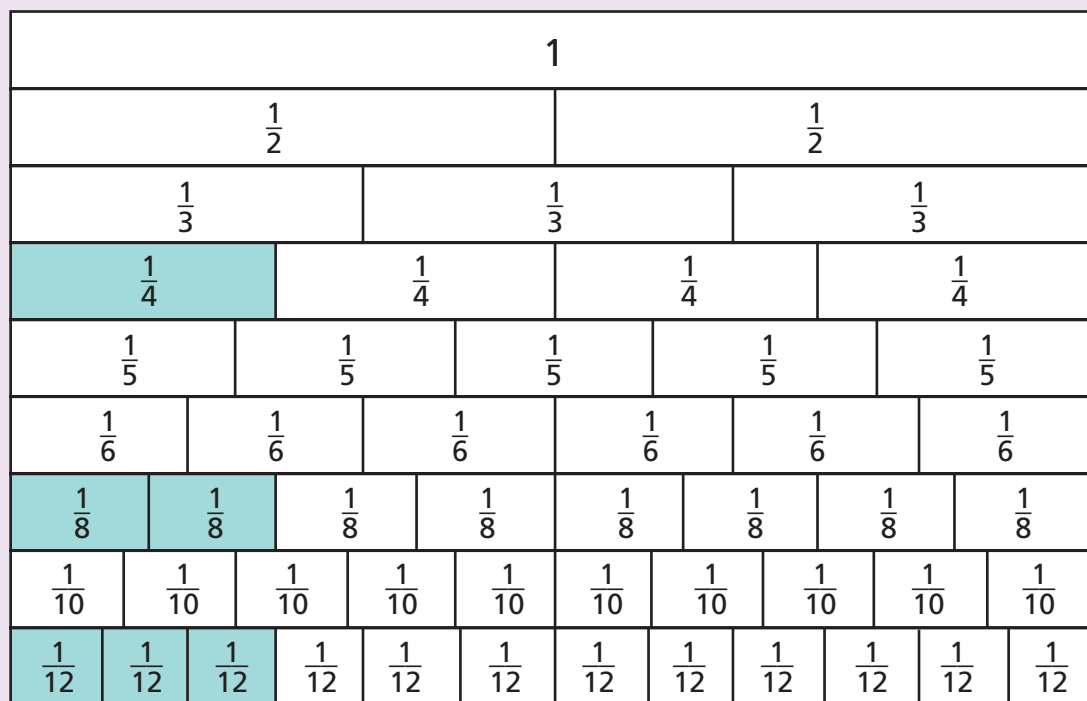
Finding Equivalent Fractions

Equivalent fractions are two or more fractions that name the same amount.

You can use fraction models to help you find equivalent fractions.

Example Find fractions equivalent to $\frac{1}{4}$.

Find the models that match the length of $\frac{1}{4}$.



$\frac{2}{8}$ and $\frac{3}{12}$ are the same length as $\frac{1}{4}$, so they are equivalent.

✓ Check for Understanding

Use the models above to write an equivalent fraction.

1 $\frac{1}{3}$

2 $\frac{1}{5}$

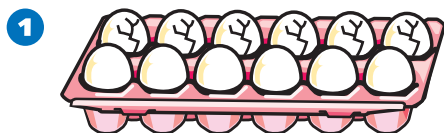
3 $\frac{1}{2}$

4 $\frac{5}{6}$

EXPLORE

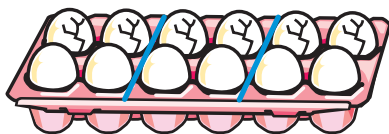
Cracked Eggs

What are some different ways to describe a half dozen?

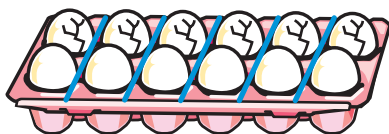


- A** How many eggs in the picture are cracked?
- B** What fraction, other than $\frac{1}{2}$, describes the cracked eggs in the picture?
-

- 2 Use a fraction to describe the number of cracked eggs in each group.

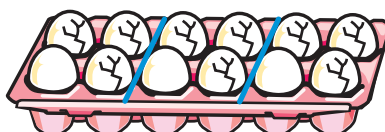
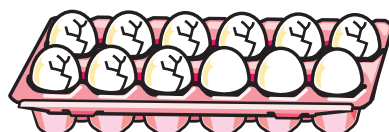


- 3 Use a fraction to describe the number of cracked eggs in each group.



- 4 What is another fraction that describes a half dozen eggs?
-

- 5 In each picture below, what fraction of the eggs are cracked?

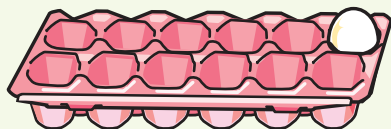


Is the same fraction of eggs cracked in each picture?

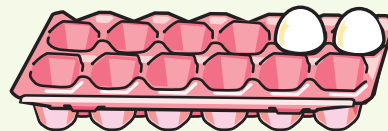
EXPLORE

Parts of a Dozen

One egg is $\frac{1}{12}$ of a dozen.

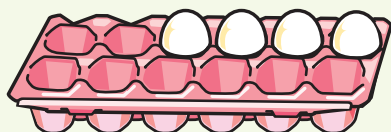


Two eggs are $\frac{2}{12}$ of a dozen.

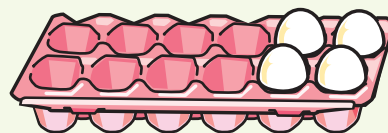


- 1 What part of a dozen is 5 eggs?

Four eggs are $\frac{4}{12}$ of a dozen.



Four eggs are also $\frac{2}{6}$ of a dozen.



- 2 Write another fraction that describes 4 eggs as part of a dozen.
- 3 What part of a dozen is 3 eggs?
Write two fractions.

Crystal has $\frac{2}{3}$ of a dozen eggs, and her friend has $\frac{3}{4}$ of a dozen eggs.

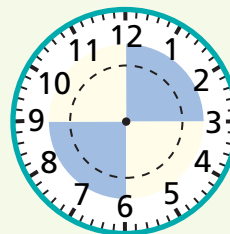
- 4 How many eggs does Crystal have?
- 5 How many eggs does her friend have?
- 6 Which is more: $\frac{2}{3}$ or $\frac{3}{4}$?

EXPLORE

Fractions of an Hour

Use the clock to help you answer the questions.

- 1 How many minutes are in an hour?
- 2 How many minutes are in a half hour?
- 3 How many minutes are in a quarter of an hour?



Ron will eat dinner in 1 hour. He plans to read for 20 minutes, do homework for 20 minutes, and play for 20 minutes.

- 4 What fraction of an hour is 20 minutes?
- 5 What fraction of an hour is 40 minutes?
- 6 Anh spends $\frac{3}{4}$ of an hour at karate class and $\frac{2}{3}$ of an hour playing piano.
Which activity lasts longer?
- 7 Yori walks his dog for $\frac{1}{2}$ of an hour every day.
Then they play together for $\frac{1}{3}$ of an hour.
Which activity lasts longer?

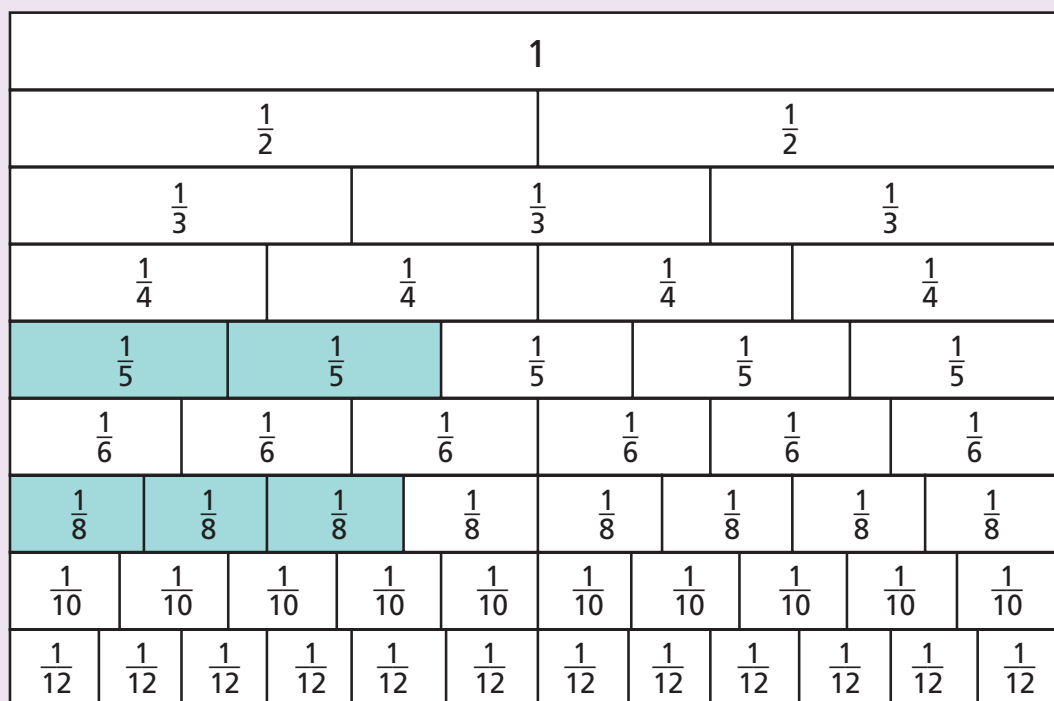
REVIEW MODEL

Using Models to Compare Fractions

You can use fraction models to help you compare fractions.

Example Compare $\frac{2}{5}$ and $\frac{3}{8}$.

Compare the lengths of the models for each fraction.



$\frac{2}{5}$ is longer than $\frac{3}{8}$, so $\frac{2}{5} > \frac{3}{8}$.

✓ Check for Understanding

Compare the fractions using $<$, $>$, or $=$.

1 $\frac{1}{2} \bullet \frac{5}{10}$

2 $\frac{3}{12} \bullet \frac{3}{8}$

3 $\frac{4}{5} \bullet \frac{5}{6}$

4 $\frac{2}{3} \bullet \frac{1}{4}$

5 $\frac{1}{6} \bullet \frac{1}{3}$

6 $\frac{5}{12} \bullet \frac{4}{10}$

REVIEW MODEL

Problem Solving Strategy

Make a Model

Kiki bought a dozen muffins. $\frac{2}{3}$ of the muffins were blueberry. $\frac{1}{4}$ of the muffins were cranberry. Did Kiki buy more blueberry or cranberry muffins?

Strategy: Make a Model

Read to Understand

What do you know from reading the problem?

$\frac{2}{3}$ of a dozen muffins are blueberry. $\frac{1}{4}$ of a dozen muffins are cranberry. You need to find out if there are more blueberry or cranberry muffins.

Plan

How can you solve this problem?

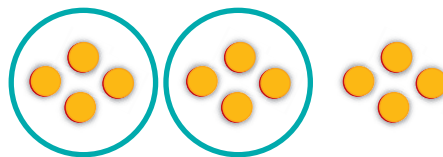
You can make a model.

Solve

How can you make a model?

You can use 12 counters to represent the dozen muffins.

To find the number of blueberry muffins, separate the counters into 3 equal groups. There are 8 counters in two groups, so Kiki bought 8 blueberry muffins.



To find the number of cranberry muffins, separate the counters into 4 equal groups. There are 3 counters in one group, so Kiki bought 3 cranberry muffins.



$8 > 3$, so Kiki bought more blueberry muffins.

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 a model*.

- 1 Lupe has some bags of coins. Each bag has 8 coins, and 7 of the 8 coins are pennies. How many pennies does Lupe have in 6 bags?
- 2 Rex made a square design with 25 tiles. He put a green tile in each corner. He used red tiles to complete the outside border. Then he filled in the center with blue tiles. How many blue tiles did Rex use?

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 Mr. Ortega is ordering 20 packages of erasers. A package of erasers costs 50¢. If he buys them in bulk, he can get 20 packages for \$7.99. How much would he save if he buys in bulk?
- 4 Carl has 6 library books and borrows 3 more. Mary Beth has 10 library books. If Carl returns 2 books, what must Mary Beth do to have the same amount as Carl?
- 5 Ms. Holt wrote some fractions. If she continues the pattern, which fraction will she write next?
 $\frac{1}{4}, \frac{2}{8}, \frac{3}{12}, \frac{4}{16}, \underline{\hspace{1cm}}?$
- 6 There are 30 people having lunch together. They want to share large submarine sandwiches. Each person will have $\frac{1}{6}$ of a sandwich. How many whole sandwiches should they order?
- 7 Lester can ride his bike 12 miles in 1 hour. How far can he travel in 6 hours?
- 8 Trina is going to ride her bike to visit her friends Hank, Marsha, and Annette. How many different ways can she order her visits?

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

- 1 Two numbers that have the same value are ____?
- 2 A fraction with 3 in the denominator describes a group divided equally into ____?
- 3 Fifteen minutes is a ____? hour.
- 4 A package of twelve items is one ____? items.
- 5 A fraction with 4 in the denominator describes a group divided equally into ____?
- 6 When two numbers are compared, the one representing more is ____? the other number.
- 7 Thirty minutes is a ____? hour.
- 8 A(n) ____? names the same amount as another fraction.

Word List A

denominator
dozen
equal
equivalent
fraction
fourths
fraction
greater than
half
halves
hour
less than
minute
numerator
quarter
thirds

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

- 9 Two is to ____? as ten is to tenths.
- 10 Minute is to ____? as day is to week.

Word List B

dozen
fraction
halves
hour

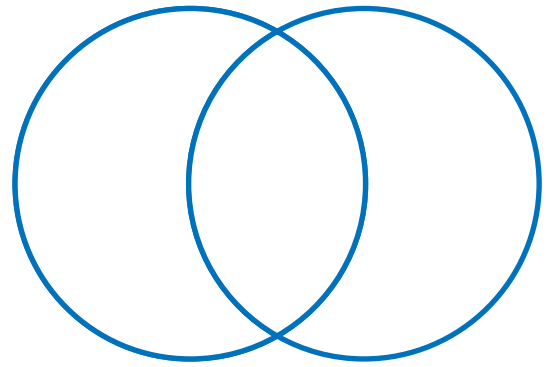
Talk Math

Discuss with a partner what you have learned about fractions. Use the vocabulary terms *fraction*, *half*, and *equal*.

- 11 How can you tell what fraction of a grid is shaded?
- 12 How can you tell whether two fractions have the same value?
- 13 How can you use what you know about minutes and hours to compare fractions?

Venn Diagram

- 14 Create a Venn diagram for the words *hour* and *minute*. Write activities that you would measure by the hour and by the minute.



Word Line

- 15 Create a word line using the words *fourth*, *half*, and *third*.

Words:

Sequence:



HOUR The words *hour* and *our* sound exactly the same, but they have very different meanings. Using the word *our* says two things. One is that the person speaking is part of a group. The other is that the group owns something.

The word *hour*, however, refers only to time. One *hour* is exactly 60 minutes long.



Technology

Multimedia Math Glossary

www.harcourtschool.com/thinkmath

GAME

Fraction Construction Zone

Game Purpose

To find equivalent fractions

Materials

- Activity Masters 79–81
- Paper bag
- Scissors



How to Play the Game

- 1** This is a game for two players.
 - Both players will use the Fraction Construction Zone gameboard and cards. Cut out 1 row of the Fraction Construction Zone cards, and put them in the paper bag.
 - Each player will need all of the Fraction Pieces. Cut them out.
- 2** Take turns. Without looking, pick a card from the bag.
 - Use the fraction pieces named on the card. If *free choice* is picked, you may choose any size you want.
 - Name an empty fraction bar on the gameboard. Use as many fraction pieces as you need to make that bar.
 - Write the equivalent fraction. You get 1 point for each fraction piece you used to make the bar.
 - If you cannot make the bar you named, you lose your turn and must take away your fraction pieces.
- 3** Take turns until all the fraction bars have been made. The player with more points wins.

GAME

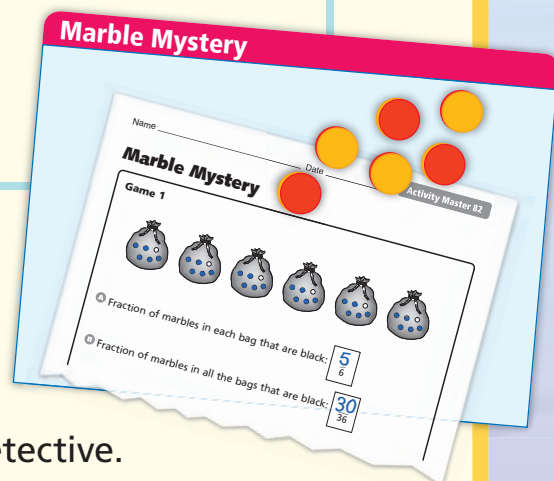
Marble Mystery

Game Purpose

To find fractional parts of sets of objects

Materials

- Activity Master 82
- Two-color counters



How to Play the Game

- 1** This is a game for 2 players. You each will need a gameboard and some counters. Choose who will be the Mystery Maker and who will be the Detective.
- 2** The Mystery Maker secretly sets up Game 1. Decide on the number of black marbles in a bag. Shade that number of marbles in each bag. Record the fractions.
- 3** The Detective asks questions to find the number of black marbles. The questions must be about the total number of marbles. You may NOT ask questions about the marbles in one bag. You may ask a question such as: *Are there more black marbles than white marbles?* You may NOT ask a question such as: *Are there 3 black marbles in a bag?* Use counters to help.
- 4** The Mystery Maker keeps track of the number of questions. The Mystery Maker gets **1 point** for every question asked. The Detective gets **2 points** for:
 - finding the total number of black marbles.
 - telling how many black marbles are in each bag.
 - modeling the bags with counters.
- 5** Switch roles. Play Game 1 again. The player with more points after two games wins.

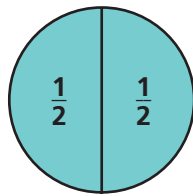
CHALLENGE

Work with a partner to discover how many different ways you can make one whole using halves, fourths, eighths, and sixteenths.

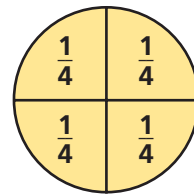
You will need 6 round paper plates, all the same size. You will also need scissors, a ruler, markers, and a bag.

Color 4 paper plates each a different color.
Then cut up the paper plates this way:

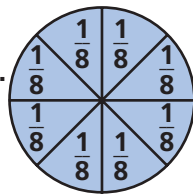
- A** Cut one plate in half. Label each part $\frac{1}{2}$.



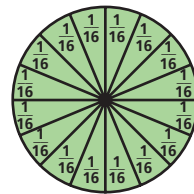
- B** Cut one plate into 4 equal parts. Label each part $\frac{1}{4}$.



- C** Cut one plate into 8 equal parts. Label each part $\frac{1}{8}$.



- D** Cut one plate into 16 equal parts. Label each part $\frac{1}{16}$.

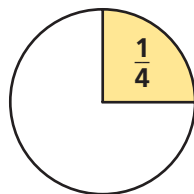


Mix up all the fraction parts and put them in a bag.

Create a New Whole Plate

- 1** Each partner starts with one whole plate. The goal is to exactly cover up your plate with fraction parts.
- 2** One partner picks a fraction part from the bag.
- 3** Take turns. If you get a fraction part and you cannot put it on your plate without overlapping, choose another part.
- 4** Record the fraction parts you used to cover your plate.
- 5** Start over. Can you cover the plate another way?

Example: On her first turn, Cho gets $\frac{1}{4}$.



After 3 turns, Cho has $\frac{1}{4}$, $\frac{1}{8}$, and $\frac{1}{8}$.

