BRIDGES IN MATHEMATICS 4

GRADE 4 SUPPLEMENT

Set A6 Numbers & Operations: Fractions & Mixed Numbers

Includes

Skills & Concepts

- ★ convert a mixed number to a fraction and vice versa, and visually represent the number
- ★ write a fraction equivalent to a given fraction
- ★ simplify fractions using common factors
- ★ compare fractions and mixed numbers using the symbols <, >, or =

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Bridges in Mathematics Grade 4 Supplement
Set A6 Numbers & Operations: Fractions & Mixed Numbers

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Bridges in Mathematics is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

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Set A6 ★ Activity 1

ACTIVITY

Fractions & Mixed Numbers

Overview

Students work with guidance from the teacher to make a set of construction paper fraction strips. Then they use their fraction kits to learn about converting fractions to mixed numbers, and vice versa.

Skills & Concepts

★ convert a mixed number to a fraction and vice versa, and visually represent the number

★ write a fraction equivalent to a given fraction

You'll need

★ Fractions & Mixed Numbers (pages A6.5 and A6.6, run a class set)

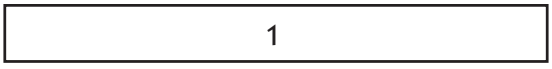
★ 1.5" x 12" construction paper strips, class set plus a few extra in each of the following colors: white, light brown, purple, green, and orange

★ class set of 6" x 9" manila or legal size envelopes

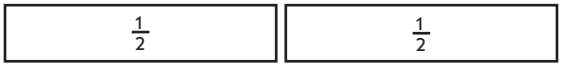
★ class set of scissors

Instructions for Fractions & Mixed Numbers

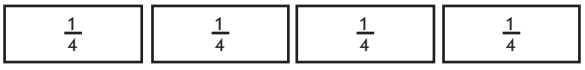
1. Explain that today everyone in class will make a set of construction paper fraction strips, and use them to learn some new things about fractions. Ask students to get out their scissors and pencils, and then give them each a set of 5 construction paper strips, one each in the following colors: white, light brown, purple, green, and orange, and reserve a set for yourself. Holding up the white strip, label it with a 1 as students do the same on their white strips.



2. Ask students to fold their light brown strip in half and cut it along the fold line as you do so with your light brown strip. What is the value of these 2 pieces relative to the white strip? After a bit of discussion, have students label each of the light brown pieces with the fraction $^1/_2$.



3. Now ask students to fold the purple strip in half and then in half again. Before they open it out, ask them to pair-share the number of segments they'll see and the value of each, relative to the white strip. Then ask them to unfold the strip, check their predictions, cut it along the fold lines, and label each part, as you do the same with your purple strip.



4. As they work, encourage students to compare and contrast the different colored pieces. In doing so, you may be able to get some sense of students' current understandings (and misconceptions) about fractions.

Activity 1 Fractions & Mixed Numbers (cont.)

Teacher *How do the purple pieces you've cut compare to the others you've cut and labeled so far?*

Students *The purple ones, the fourths, are half the size of the halves.*
Yeah, a fourth is like half of a half.
Right! It's like a half folded in half again.
If you put 2 of the fourths together, they're the same as a half.

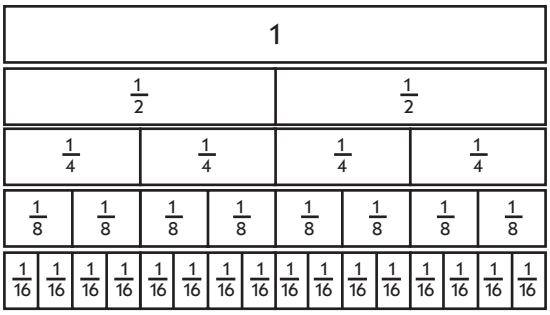
5. Next, ask students to fold their green strip in half, in half again, and in half a third time. Before they open it out, have them pair-share their ideas about how many segments they'll see and how the size of each will compare to the white strip, the designated "whole". You may discover in doing this that while some students believe they'll see 8 segments when they unfold the strip, some may be equally convinced that they'll see 6. In either case, ask students to explain their thinking.

6. When students unfold their green strips, they'll discover that, in fact, they're able to see 8 segments. If there's been debate beforehand, continue the discussion as students cut and label each of the green pieces.

Students *I think what's doubling is the number of pieces. Every time you fold the strip, you get double the number of pieces you got the last time, like 2 is double 1, 4 is double 2, and 8 is double 4. So it is a doubling pattern, just different from how some of us thought.*

7. Now ask students to fold their orange strip in half 4 times. Again, have them make predictions about the number of segments they'll see when they unfold the strip and the size of each of the segments relative to the others they've cut. After some discussion, have them cut the orange strip along the folds and label each of the pieces.

8. As they finish cutting and labeling their pieces, have students each arrange the fraction pieces from largest to smallest in front of them, as shown below.



9. Give the children a minute or two to pair share any mathematical observations they can make about these pieces and then invite volunteers to share their thinking with the class.

Then write the fractions shown below on the board or the overhead, one at a time. As you record each fraction, read it with the class and ask students to use their pieces to build it. Encourage them to share observations with one another and the class as they work.

$3/16$ $5/8$ $3/4$ $5/16$ $7/16$

Activity 1 Fractions & Mixed Numbers (cont.)

Students *$^{3}/_{16}$ is the same as an eighth and a sixteenth.*
Yes, but there's no one piece that matches $^{3}/_{16}$ exactly.
It's the same with $^{5}/_{8}$. You can make the same amount with one half and one eighth, but there's not just one piece that matches.
$^{5}/_{16}$ is just one more sixteenth than $^{1}/_{4}$, and $^{7}/_{16}$ is just one sixteenth less than $^{1}/_{2}$.

10. Write the fraction $^{3}/_{2}$ on the board. Ask student pairs to share their pieces to make this fraction. Then invite their comments. What observations can they make about this fraction? Is there a way they can build the same quantity with *fewer* pieces?

Students *It's bigger than 1.*
It's just 3 halves – it's easy to make.
You can also just put a whole strip and a half to make the same amount. $^{3}/_{2}$ is the same as 1 $^{1}/_{2}$.
$^{3}/_{2}$ is a weird fraction because the number on top is more than the number on the bottom.

11. Write the following equation on the board:

$$^{3}/_{2} = 1\,^{1}/_{2}$$

Explain that when a fraction has a numerator greater than the denominator, it is sometimes called an *improper fraction*. There's really nothing "improper" at all about fractions like these, but people often change such a fraction to a *mixed number*, or a number that includes both a whole number and a proper fraction that is less than 1.

12. Write the fractions shown below on the board or overhead one at a time. Ask student pairs to build each one as written and then build it a second time in the form of a mixed number. Note with them that it takes fewer pieces to build each fraction as a mixed number. Encourage them to share observations with one another and the class as they work.

$^{6}/_{4}$ $^{10}/_{8}$ $^{20}/_{16}$ $^{12}/_{8}$ $^{8}/_{4}$

Students *You can make $^{6}/_{4}$ with a whole strip and $^{2}/_{4}$, but it's also the same as 1 $^{1}/_{2}$.*
It's way faster to make a mixed number for $^{10}/_{8}$. It's just a whole strip and 2 more eighths.
We said it was the same as 1 $^{1}/_{4}$, because $^{2}/_{8}$ is the same as a fourth.
I don't think $^{8}/_{4}$ is a mixed number because it's just 2. There's no fraction left.

13. Next, write the mixed numbers shown below. Ask student pairs to build each and then build it a second time in the form of a fraction. Can they begin to predict how many fractional pieces of the same size it will take to make a mixed number without laying them all out?

$1\,^{3}/_{4}$ $1\,^{6}/_{8}$ $1\,^{8}/_{16}$ $2\,^{2}/_{4}$ $2\,^{5}/_{8}$

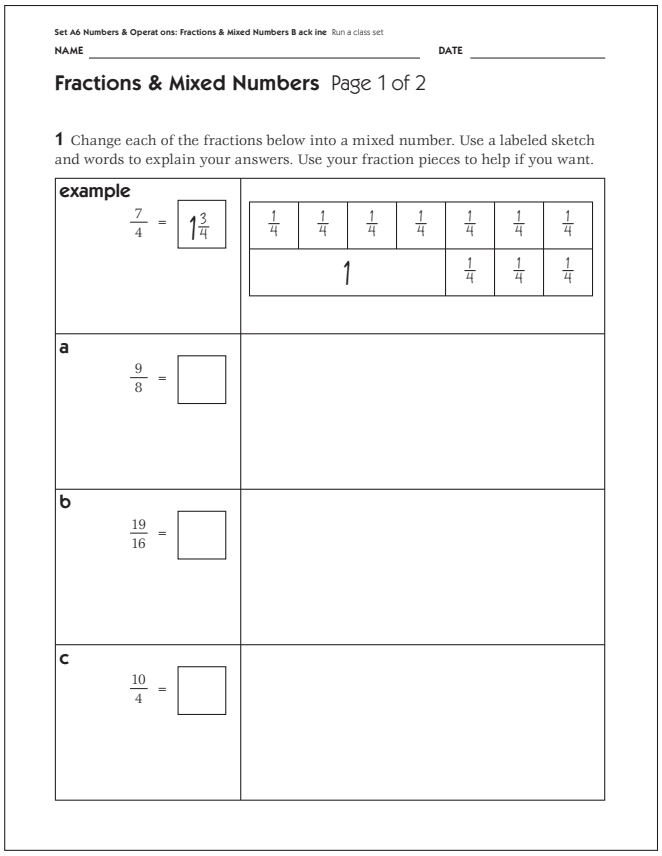
Tressa *We don't have enough fourths to make 2 $^{2}/_{4}$. Why not?*

Ian *Because it's 4 fourths for each whole and then 2 more. We need 10 fourths, but we only have 8 fourths.*

Hillary *It's going to be the same with 2 $^{5}/_{8}$. That would take 8 eighths for each whole strip, and then 5 more. 8 + 8 + 5 = 21 eighths. We don't have that many.*

Activity 1 Fractions & Mixed Numbers (cont.)

14. Finally, give students each a copy of Fractions and Mixed Numbers. Review the instructions on the sheet with the class. When they understand what to do, let them go to work. Circulate to provide assistance as needed. Encourage students to use their fraction strips and help one another.



Set A6 Numbers & Operat ons: Fractions & Mixed Numbers B ack ine Run a class set

NAME _____ DATE _____

Fractions & Mixed Numbers Page 1 of 2

1 Change each of the fractions below into a mixed number. Use a labeled sketch and words to explain your answers. Use your fraction pieces to help if you want.

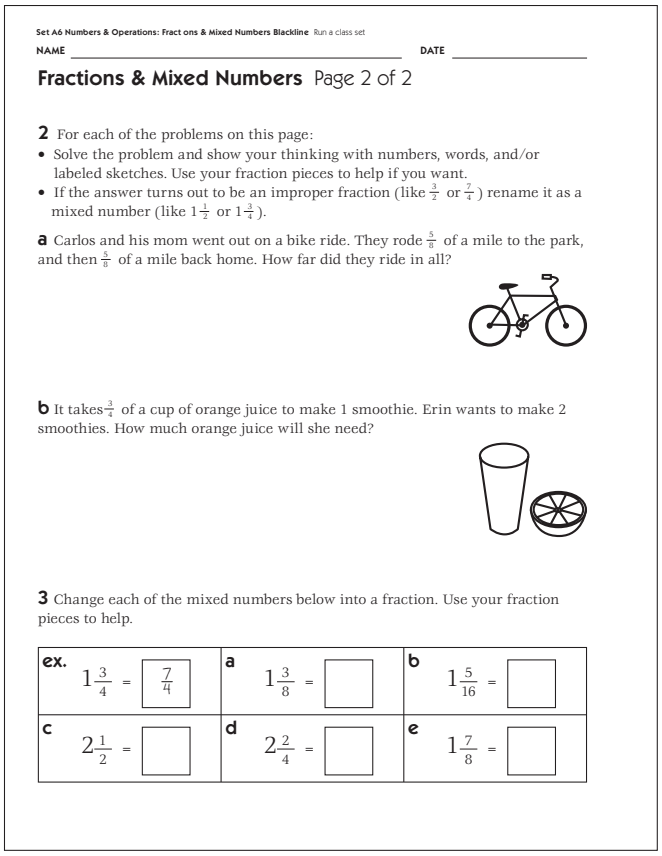
example

$\frac{7}{4} = 1\frac{3}{4}$

a $\frac{9}{8} =$ ☐

b $\frac{19}{16} =$ ☐

c $\frac{10}{4} =$ ☐



Set A6 Numbers & Operations: Fract ons & Mixed Numbers Blackline Run a class set

NAME _____ DATE _____

Fractions & Mixed Numbers Page 2 of 2

2 For each of the problems on this page:
- Solve the problem and show your thinking with numbers, words, and/or labeled sketches. Use your fraction pieces to help if you want.
- If the answer turns out to be an improper fraction (like $\frac{3}{2}$ or $\frac{7}{4}$) rename it as a mixed number (like $1\frac{1}{2}$ or $1\frac{3}{4}$).

a Carlos and his mom went out on a bike ride. They rode $\frac{5}{8}$ of a mile to the park, and then $\frac{5}{8}$ of a mile back home. How far did they ride in all?

b It takes $\frac{3}{4}$ of a cup of orange juice to make 1 smoothie. Erin wants to make 2 smoothies. How much orange juice will she need?

3 Change each of the mixed numbers below into a fraction. Use your fraction pieces to help.

ex. $1\frac{3}{4} = \frac{7}{4}$	**a** $1\frac{3}{8} =$ ☐	**b** $1\frac{5}{16} =$ ☐
c $2\frac{1}{2} =$ ☐	**d** $2\frac{2}{4} =$ ☐	**e** $1\frac{7}{8} =$ ☐

15. Give each student a manila or legal sized envelope in which to store his or her fraction kit. Let them know that it's fine to fold the white strip so it will fit into the envelope. Then have students label their envelopes with their names and store them safely so they can use these fraction kits for the next activity in this set.

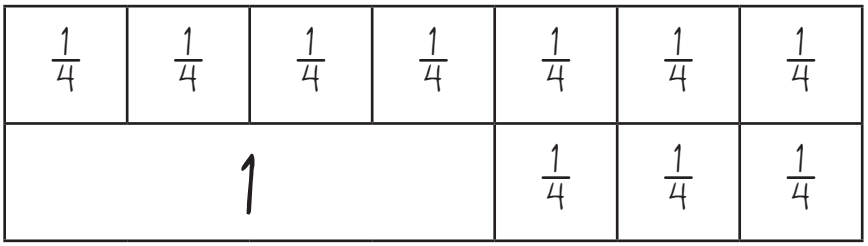
NAME _____ **DATE** _____

Fractions & Mixed Numbers Page 1 of 2

1 Change each of the fractions below into a mixed number. Use a labeled sketch and words to explain your answers. Use your fraction pieces to help if you want.

example

$\frac{7}{4} = 1\frac{3}{4}$



a

$\frac{9}{8} =$ ☐

b

$\frac{19}{16} =$ ☐

c

$\frac{10}{4} =$ ☐

NAME _____ **DATE** _____

Fractions & Mixed Numbers Page 2 of 2

2 For each of the problems on this page:

- Solve the problem and show your thinking with numbers, words, and/or labeled sketches. Use your fraction pieces to help if you want.
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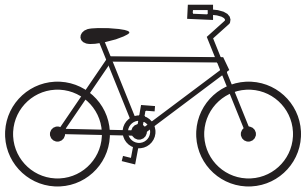

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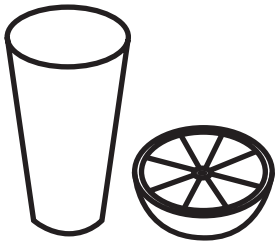


3 Change each of the mixed numbers below into a fraction. Use your fraction pieces to help.

ex. $1\frac{3}{4} = \boxed{\frac{7}{4}}$	**a** $1\frac{3}{8} = \boxed{}$	**b** $1\frac{5}{16} = \boxed{}$
c $2\frac{1}{2} = \boxed{}$	**d** $2\frac{2}{4} = \boxed{}$	**e** $1\frac{7}{8} = \boxed{}$

Set A6 ★ Activity 2

ACTIVITY

Simplify & Compare

Overview

Students use their fraction kits from the previous activity to learn to simplify fractions. Then the teacher introduces a new game to provide more practice with simplifying and comparing fractions. Simplify & Compare can be used as a partner game once it has been introduced to the class, or played several times as a whole group.

Skills & Concepts

- ★ simplify fractions using common factors
- ★ convert a mixed number to a fraction and vice versa, and visually represent the number
- ★ compare fractions and mixed numbers using the symbols <, >, or =
- ★ write a fraction equivalent to a given fraction

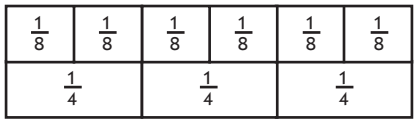
You'll need

- ★ Simplify & Compare Game Board (page A6.11, run 1 copy on a transparency)
- ★ Simplify & Compare Record Sheet (page A6.12, run a class set)
- ★ students' fraction kits from Set A6, Activity 1
- ★ overhead double spinner
- ★ a more/less cube
- ★ overhead pens
- ★ 1.5" x 12" pink construction paper strips, one per student plus a few extra
- ★ rulers, class set
- ★ scissors, class set

Instructions for Simplify & Compare

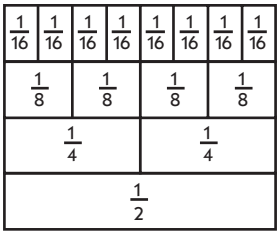
1. Explain that students are going to use their fraction kits to learn some more about fractions and play a new game today. Have them take all the fraction strips out of their envelopes and stack them in neat piles by size on their desks.

2. Write the fraction $^6/_8$ at the overhead. Read it with the students and ask them to build the fraction with their pieces. Then challenge them to lay out an equivalent fraction with fewer pieces that are all the same size. Most will set out three fourths in response. If some students set out one half and one fourth, remind them that all the pieces in the equivalent fraction have to be the same size.



3. Ask students to share any observations they can make about the two sets of pieces. Record the equation $^6/_8 = {}^3/_4$ on the overhead, and have students return the pieces they have just used to their stacks. Then write $^8/_{16}$, and have students show this fraction with their pieces. When most have finished, ask them to build all the equivalent fractions they can find, using only same-sized pieces for each one. Give them a minute to work and talk with one another, and then invite volunteers to share their results.

Activity 2 Simplify & Compare (cont.)



Students *I got $^{8}/_{16}$, $^{4}/_{8}$, $^{2}/_{4}$, and $^{1}/_{2}$.*
They're all the same as $^{1}/_{2}$.
When you use bigger pieces, you don't need as many.

4. Write a series of numbers and arrows on the board to represent the sequence. Ask students to pair-share any observations they can make about the sequence of fractions, and then have volunteers share their ideas with the class. Can they find and describe any patterns? How do the numbers relate to one another? Which requires the fewest pieces to build?

$^{8}/_{16} \rightarrow {}^{4}/_{8} \rightarrow {}^{2}/_{4} \rightarrow {}^{1}/_{2}$

Students *The numbers on the top, the numerators, go 8, 4, 2, and 1. It's like they keep getting cut in half.*
It's the same with the numbers on the bottom. 16 ÷ 2 is 8. 8 ÷ 2 is 4. 4 ÷ 2 is 2.
A half was the fastest way to build the fraction.
I knew $^{8}/_{16}$ was a half to begin with because 8 is half of 16.
Every number on the top is half of the number on the bottom.

5. Press students to consider the last fraction in the sequence, $^{1}/_{2}$. Is there any way to build $^{8}/_{16}$ with even fewer pieces than the one half piece? Why not? Give them a minute to discuss the question, and then explain that $^{1}/_{2}$ is the simplest way to show $^{8}/_{16}$. Tell the class that *a fraction is in its simplest form when its numerator and denominator have no common factors other than 1.*

6. Remind students that *a factor is a whole number that divides exactly into another number.* One way people find factors of a number is to think of the pairs of numbers that can be multiplied to make that number. Work with input from the students to list the factors of 8 and 16.

Factors of 8 are 1, 2, 4, and 8. You can divide 8 by each of these numbers.

$1 \times 8 = 8$ $2 \times 4 = 8$

Factors of 16 are 1, 2, 4, 8, and 16. You can divide 16 by each of these numbers.

$1 \times 16 = 16$ $2 \times 8 = 16$ $4 \times 4 = 16$

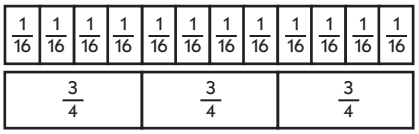
7. Work with input from the class to identify and circle the factors 8 and 16 have in common: 1, 2, 4, and 8. Then draw students' attention back to $^{1}/_{2}$. Since 1 and 2 have no common factor other than 1, there's no way to further simplify the fraction.

8. Explain that you can find the simplest form of a fraction by building it with the fewest number of pieces. But you can also simplify a fraction by identifying the *greatest common factor*, or the biggest number by which you can divide both the numerator and the denominator. Write $^{12}/_{16}$ on the board. Can this fraction be simplified? Ask students to pair-share ideas about the largest number by which both 12 and

Activity 2 Simplify & Compare (cont.)

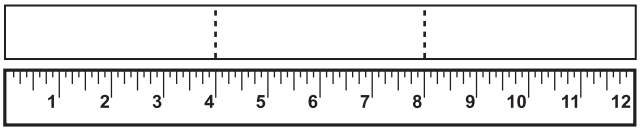
16 can be divided. When they have identified 4 as the greatest common factor of 12 and 16, record the operation shown below at the overhead, and ask students to confirm it with their pieces. Is it true that $^{12}/_{16}$ cannot be built with any fewer pieces than 3 fourths?

$$\frac{12 \div 4}{16 \div 4} = \frac{3}{4} \qquad \frac{12}{16} = \frac{3}{4}$$



9. Repeat step 8 with $^{10}/_{16}$, $^{3}/_{16}$, and $^{6}/_{4}$. Students will note that $^{3}/_{16}$ cannot be simplified because 3 and 16 have no factors in common other than 1. They will also discover that $^{6}/_{4}$ simplifies to $^{3}/_{2}$ and then converts to a mixed number, $1^{1}/_{2}$.

10. Now explain that you're going to play a new game with students that will give them more opportunities to simplify fractions. Ask them to carefully re-stack all their fraction strips by size, and tell them that they're going to need to cut one more strip to have all the pieces they need for the game. Ask them to get out their rulers, pencils, and scissors. Then give them each a 1.5" by 12" strip of pink construction paper. Have them use the inch side of their ruler to mark and cut the strip at 4" intervals. If the entire strip represents 1, what fraction does each of the pink pieces represent? Why?



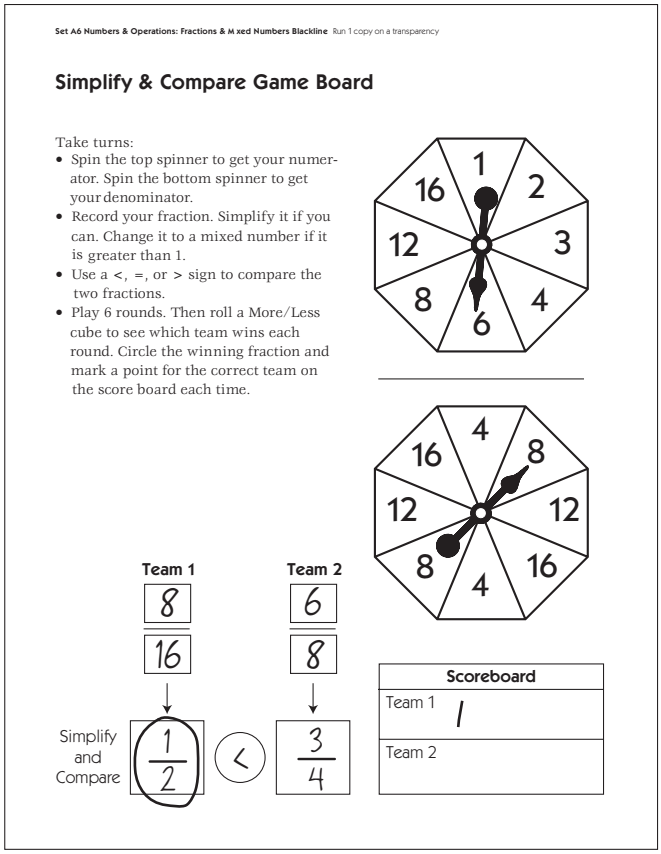
11. Place the Simplify & Compare game board on display at the overhead. Give students a few moments to examine it quietly, and then read the game rules with the class. Explain that they are going to play as Team 2, and you will play as Team 1. You will play a trial round so everyone can learn the rules, and then play the whole game with them.

12. Place the double spinner overlay on top of the spinners, spin both, and record the results under "Team 1". Work with students to simplify your fraction by identifying the greatest number by which both the numerator and the denominator can be divided. Encourage them to check the results with their pieces as well.

13. Invite a volunteer up to the overhead to spin for the class. Record the students' fraction under "Team 2" and work with their input to simplify it. Then ask students to compare their fraction with yours. If they are not sure which fraction is greater, have them build both with their fraction pieces. Use a <, >, or = sign to show the results. Then have a second volunteer roll the more/less cube to determine the winner. Circle the winning fraction on the overhead.

> ***Teacher*** *I really lucked out on this first trial. I thought you were going to win because $^{3}/_{4}$ is greater than $^{1}/_{2}$, but Kendra rolled "less" instead of "more".*

Activity 2 Simplify & Compare (cont.)



14. Once the trial round is completed, erase the overhead. Give students each a copy of the Simplify & Compare record sheet and play 6 rounds with the class. You will need to erase the overhead between each round, but students will have a record of the complete game on their sheets. At the end of the game, have students take turns rolling the more/less cube for each pair of fractions. Have them circle the winning fraction for each round, fill in the scoreboard on their papers, and determine the winning team. If any of the pairs of fractions are equal, both teams score a point for the round.

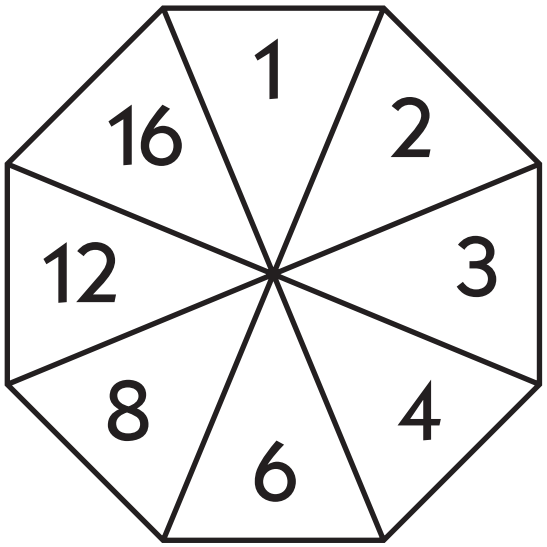
Extensions

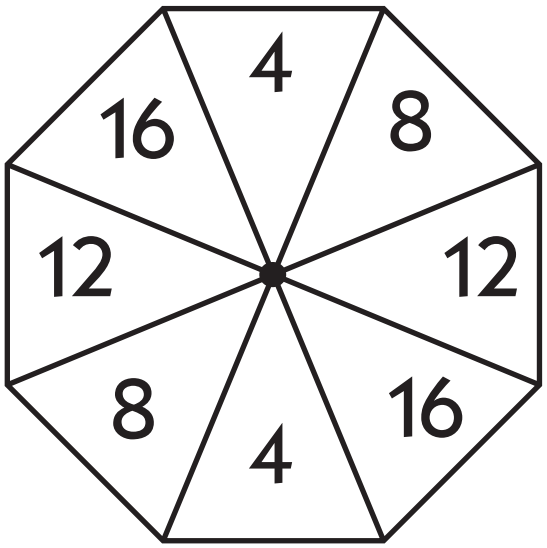
- Play Simplify & Compare several times with the class. The game provides an engaging context in which to practice simplifying and comparing fractions, and you don't have to play all 6 rounds at once.
- Run extra copies of the record sheet and game board, and have the students play the game in pairs. Encourage them to use their fraction kits to confirm their answers if necessary.
- Additional excercises and problems for students to simplify fractions and move back and forth between fractions and mixed numbers can be found in the Bridges Grade 4 Practice Book on The Math Learning Center website: www.mathlearningcenter.org. The Practice Book can be found under the link for Bridges Support for Teachers > Grade 4 > Supplements 4.

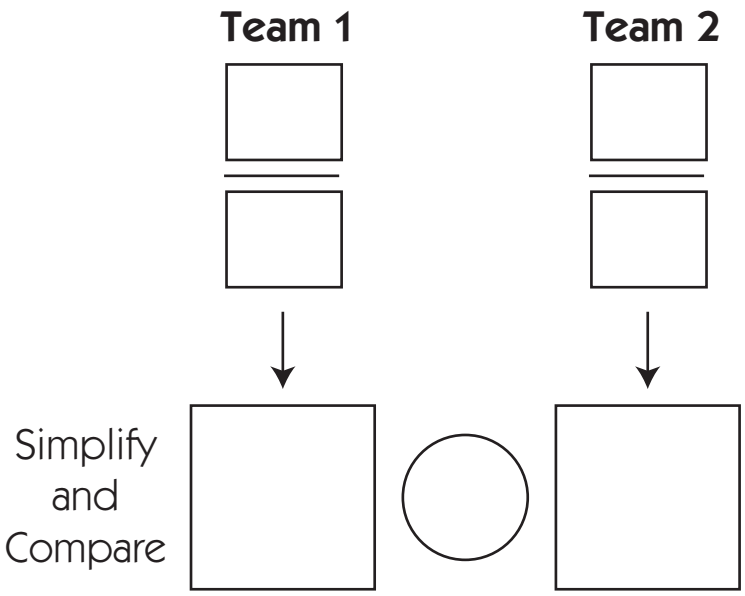
Simplify & Compare Game Board

Take turns:

- Spin the top spinner to get your numer ator. Spin the bottom spinner to get your denominator.
- Record your fraction. Simplify it if you can. Change it to a mixed number if it is greater than 1.
- Use a <, =, or > sign to compare the two fractions.
- Play 6 rounds. Then roll a More/Less cube to see which team wins each round. Circle the winning fraction and mark a point for the correct team on the score board each time.







Scoreboard
Team 1
Team 2

NAME _____ **DATE** _____

Simplify & Compare Record Sheet

Round 1	Round 2
Team 1 Team 2 Simplify and Compare	Team 1 Team 2 Simplify and Compare
Round 3	**Round 4**
Team 1 Team 2 Simplify and Compare	Team 1 Team 2 Simplify and Compare
Round 5	**Round 6**
Team 1 Team 2 Simplify and Compare	Team 1 Team 2 Simplify and Compare
Scoredboard	
Team 1	Team 2