What to Look For

- Do students recognize fractions equivalent to one-half and one whole?
- How do students use benchmark numbers?
- What evidence of misunderstandings do you observe?
- What models of fractions do students refer to or draw?

Variations

- Reduce the number of cards in each hand to four or increase it to six.
- Add fraction cards with denominators that are not factors of twelve, for example, fifths, eighths, and tenths.
- With a different set of cards, this same game could be played with (or include) mixed numbers or decimal numbers.

Exit Card Choices

- Should the card showing $\frac{1}{4}$ go to the left or the right of the card showing $\frac{1}{3}$? Explain how you know.
- Choose five cards from the deck of *Order Up* Cards and place them so that each card is equivalent to or less than the card on its right. Write the numbers.
- One team thinks it has won, but its cards show $\frac{2}{5}$ as greater than $\frac{3}{4}$. Write and draw to show the team that $\frac{3}{4}$ is greater than $\frac{2}{5}$.

Extension

Give students the following writing assignment: *Write in your journal about different ways to decide which of two fractions is greater or if they are equivalent. Include why you should have a variety of strategies to compare fractions.*

Fraction Action

Why This Game or Puzzle?

As mentioned earlier in this chapter, whole number thinking can lead some students to order fractions incorrectly, by comparing both numerators and both denominators rather than the relationship between each numerator and its denominator. Research suggests that students maintain misconceptions (Cramer, Post, and delMas 2002), so they are not likely to change the ways in which they see relationships unless they are in a situation that causes them to question their original thinking. Students need opportunities to talk about how they compare fractions and challenge each other's thinking. It is critical that we establish learning communities that support such interactions.

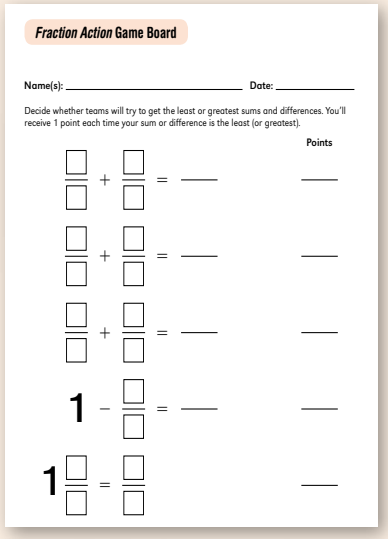
Along with ordering fractions, forming them with a particular goal in mind draws students' attention to the relative sizes of fractions and, thus, the relative relationship between the numerator and the denominator. This game also provides practice with addition and subtraction of fractions, as players try to form expressions with two fractions to get the least (or greatest) values.

Math Focus

- Comparing fractions
- Adding and subtracting fractions

Materials Needed

- 1 *Fraction Action* Game Board per team (page A-76)
- 1 deck of *Fraction Action* Cards per group of players (made from *two* copies of page A-77)
- Optional: 1 *Fraction Action* Directions per group (page A-78)


Fraction Action Game Board

Name(s): _____ Date: _____

Decide whether teams will try to get the least or greatest sums and differences. You'll receive 1 point each time your sum or difference is the least (or greatest).

Points

$\frac{\square}{\square} + \frac{\square}{\square} = \_\_\_$ ____

$\frac{\square}{\square} + \frac{\square}{\square} = \_\_\_$ ____

$\frac{\square}{\square} + \frac{\square}{\square} = \_\_\_$ ____

$1 - \frac{\square}{\square} = \_\_\_$ ____

$1\frac{\square}{\square} = \frac{\square}{\square}$ ____

Directions

Goal: Place numerators and denominators in the spaces on the game board, making fractions that—when added or subtracted—form the least or greatest sums and differences.

- Play with two or more teams.
- Shuffle the cards and place them facedown in a pile.
- Decide if the greatest or least sums or differences will receive a point.
- Turn over the top card.
- Each team separately decides in which of the twenty squares on its board to write the number. Be sure to note that two discard squares are available as choices. Once you've written a number, you cannot change it. When everyone has placed the number, turn over the next card.
- Play continues until all twenty squares on the game board have been filled.
- Each team adds and subtracts to complete the equations.
- Compare each sum or difference. The team with the greatest (or least) sum or difference gets 1 point.
- Write your total score. The team with the greatest (or least) total wins.

How Does It Work?

"Game time!" This is always a welcome phrase in this fifth-grade teacher's classroom. This teacher chooses to introduce *Fraction Action* by displaying one part of the game board (see Figure 7.8) on his projection device.

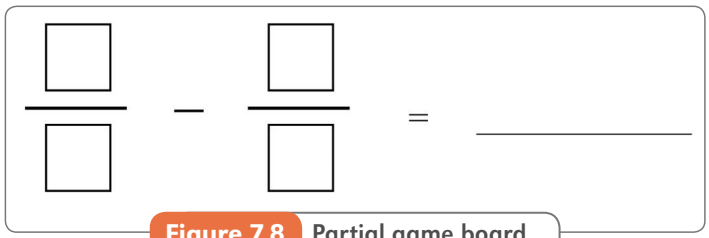


Figure 7.8 Partial game board

He holds one deck of the *Fraction Action* Cards in his hand and tells students that he will randomly ask someone to choose a card, which will then be placed in one of the empty squares in the display. After four cards have been placed, the teacher asks all students to compute the answer to the subtraction problem. He encourages students to share answers at their tables, confirming the correct answer before sharing with the class. Once all have agreed, the teacher then announces a new twist. He asks students to work together to see if a different arrangement of the numbers would create a difference that is greater.

As the teacher circulates, he hears Carla saying, "If we put the 3 in the numerator, it will make the second fraction smaller and that will make our difference bigger."

At another table, Seleem comments, "Let's put the 4 in the numerator and the 5 in the denominator of the first fraction because that's pretty close to one." The teacher appreciates the students' conversations about how moving the numbers will affect the final difference and is also pleased to see their understanding of how the relationship between the numerator and the denominator changes the size of the number.

Once students have rearranged the numbers and discussed the final results, the teacher tells the students they will now have the opportunity to turn this activity into a game. He reviews the directions of the game and hands out game boards and cards, encouraging them to use this same thinking about fraction relationships while playing the game.

Tips from the Classroom

- Some students may place numbers somewhat randomly at first and this is fine. They will learn from the outcomes of their initial examples.
- Some students will benefit from having a fraction manipulative available.
- Sometimes students forget that some of their whole number computation strategies can be applied to fractions. You may need to remind some students that they can, for example, "think addition" or use an open number line.

What to Look For

- What if-then thinking do students use as they discuss their choices?
- What evidence do you have that students recognize the relationship between the numerator and the denominator in a fraction?

- What strategies do students use to add and subtract?
- If students use drawings to help them subtract, do they use a take-away model or another meaning of subtraction, such as comparison?

Variations

- Choose particular target sums or differences for each equation and have each team's score be the difference between these targets and the actual sums and differences found. The lower score wins.
- Increase the number of cards in the deck and provide four discard boxes on the game board.

Exit Card Choices

- If you could use each of the numbers 1, 2, 3, and 4 only once and you wanted the greatest difference, where would you place them in this example?

$$\frac{\square}{\square} - \frac{\square}{\square} = \underline{\qquad\qquad}$$

- Use an example from your game and explain how you compared the sums or differences to see which team received a point.

Figure 7.9 shows a response to the second exit question. Note that the student refers to the benchmark one-half.

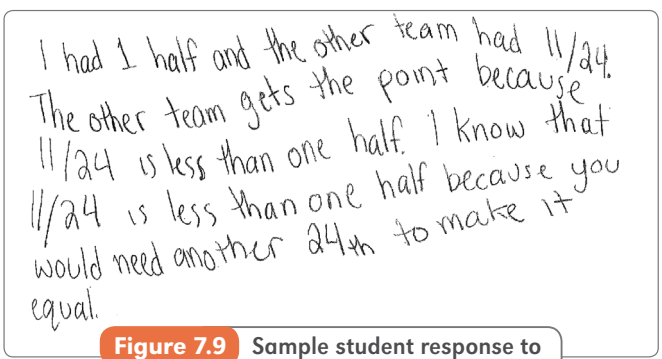

I had 1 half and the other team had 11/24. The other team gets the point because 11/24 is less than one half. I know that 11/24 is less than one half because you would need another 24th to make it equal.

Figure 7.9 Sample student response to second exit card question

Extension

Students choose four of the cards, each showing a different number. Students then explore arrangements of the numerators and denominators to find how many different sums they can get.

Fraction Action Game Board

Name(s): _____ **Date:** _____

Decide whether teams will try to get the least or greatest sums and differences. You'll receive 1 point each time your sum or difference is the least (or greatest).

Points

$\frac{\square}{\square} + \frac{\square}{\square} =$ _____ _____

$\frac{\square}{\square} + \frac{\square}{\square} =$ _____ _____

$\frac{\square}{\square} + \frac{\square}{\square} =$ _____ _____

$1 - \frac{\square}{\square} =$ _____ _____

$1\frac{\square}{\square} = \frac{\square}{\square}$ _____

Discard boxes: ☐ ☐ **Total score:** _____

Fraction Action Cards

Make two copies of the cards to form one deck.

1	1	2	2
3	3	3	4
4	4	5	5
6	6	8	8
10	10	12	12

Fraction Action Directions

Materials Needed

- 1 deck of *Fraction Action* Cards per group of players (made from *two* copies of page A-76)
- 1 *Fraction Action* Game Board per team (page A-77)
- Optional: 1 *Fraction Action* Directions per group

Directions

Goal: Place numerators and denominators in the spaces on the game board, making fractions that—when added or subtracted—form the least or greatest sums and differences.

- Play with two or more teams.
- Shuffle the cards and place them facedown in a pile.
- Decide if the greatest or least sums or differences will receive a point.
- Turn over the top card.
- Each team separately decides in which of the twenty squares on its board to write the number. Be sure to note that two discard squares are available as choices. Once you've written a number, you cannot change it. When everyone has placed the number, turn over the next card.
- Play continues until all twenty squares on the game board have been filled.
- Each team adds and subtracts to complete the equations.
- Compare each sum or difference. The team with the greatest (or least) sum or difference gets 1 point.
- Write your total score. The team with the greatest (or least) total wins.