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ABeCeDarian

STUDENT WORKBOOK

Fractions

An Introduction

2018-01 EDITION



a-be-ce-dar-i-an n.

1. One who teaches or studies the alphabet.
2. One who is just learning; a beginner.

a•be•ce•dar•i•an adj.

1. Having to do with the alphabet.
2. Being arranged alphabetically.
3. Elementary or rudimentary.

[Middle English, from Medieval Latin abecedarium, alphabet, from Late Latin abecedarius, alphabetical : from the names of the letters A B C D + -arius, -ary.]

from The American Heritage Dictionary, Third Edition

ABeCeDarian Fractions - An Introduction

Student Workbook

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ABeCeDarian Fractions - An Introduction

LESSON 1

Lesson 1 - Student Activities 1 and 2

In this lesson the student will begin with an activity to show what fractions are and why they are necessary. To do the activity, you will need to cut out the squares for Activities 1 and 2 on the facing page.

Give the student the sheet for Student Activity 1 as well as the 8 blue squares. Ask her to divide the 8 squares into 4 equal groups, as if the squares were brownies that 4 people were sharing equally.

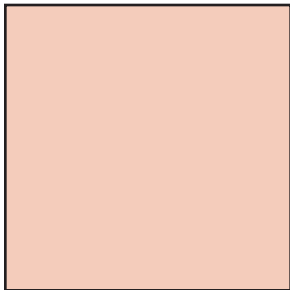
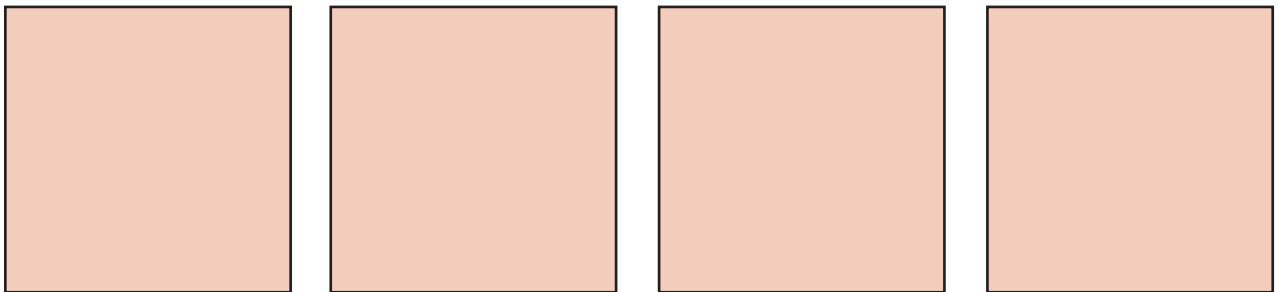
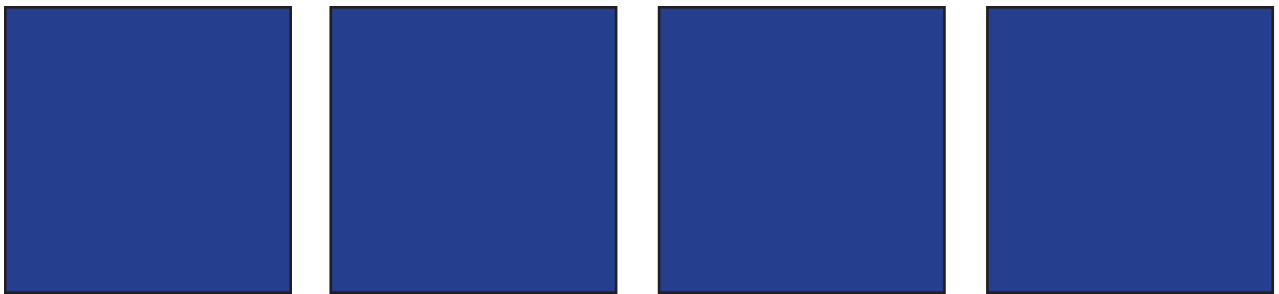
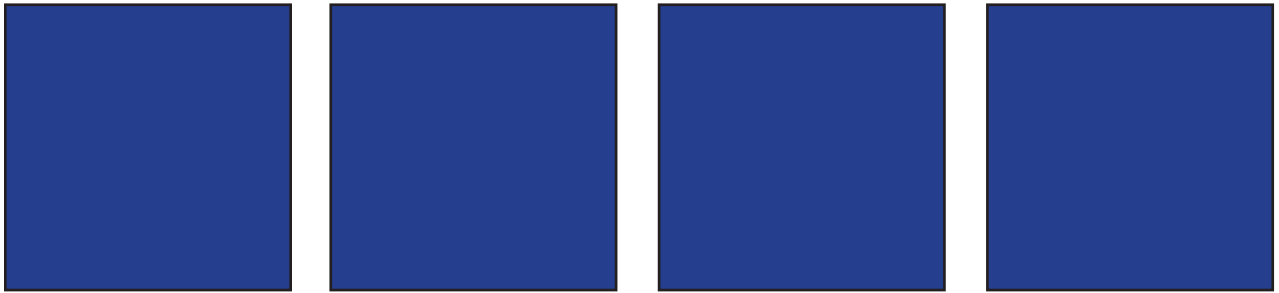
Then give the student the sheet for Student Activity 2. Give her the 5 beige squares and ask her also to divide them into 4 equal groups. The student will soon find that there is 1 whole square in each group with one left over. Tell her she has to divide that 1 extra square equally among the 4 piles; there can be no leftovers, and everyone has to have an equal portion.

The solution is to divide the remaining square into 4 equal parts and put one of these parts in each pile. Give the student time to come up with the solution herself if she doesn't see it right away. If she remains stuck after several minutes, ask her, "What if 4 people wanted to share 1 pizza pie. How would they do it?" and follow-up with additional questions as necessary until the student discovers the answer.

After the student has successfully divided the 5 squares into 4 equal groups, ask how dividing the 5 squares into 4 groups was different from dividing the 8 squares into 2 groups. Continue discussing the question with the student until she identifies that in the second activity, a whole had to be broken into parts to complete the task.

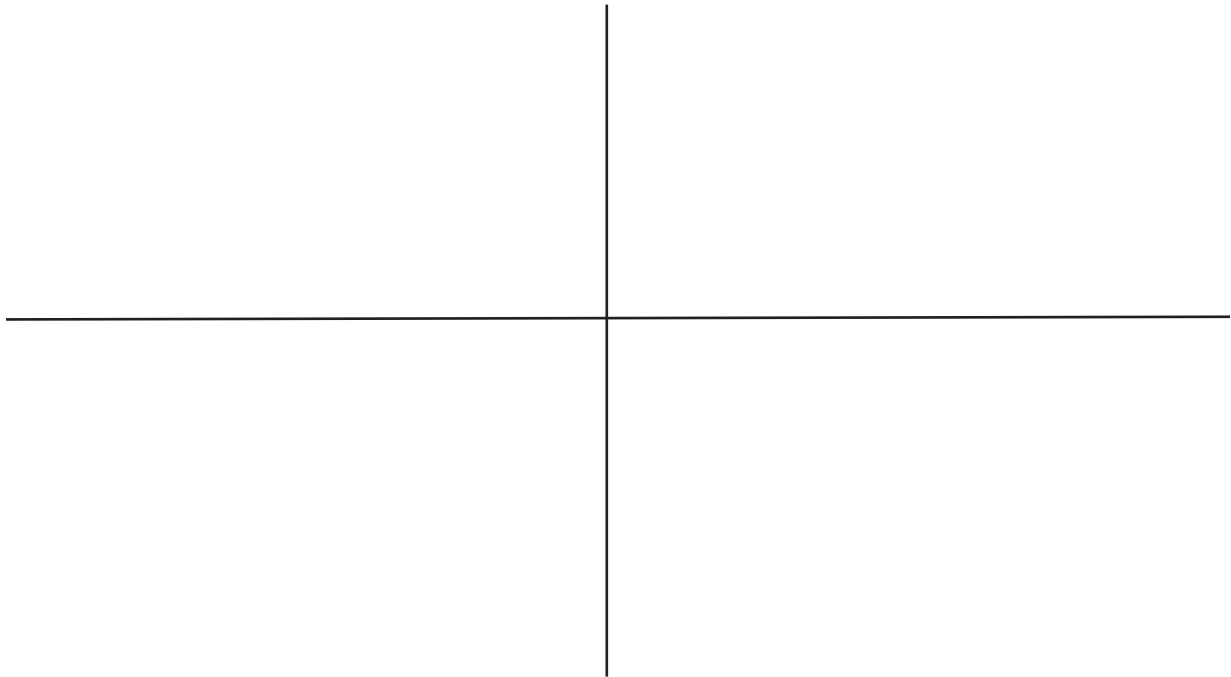
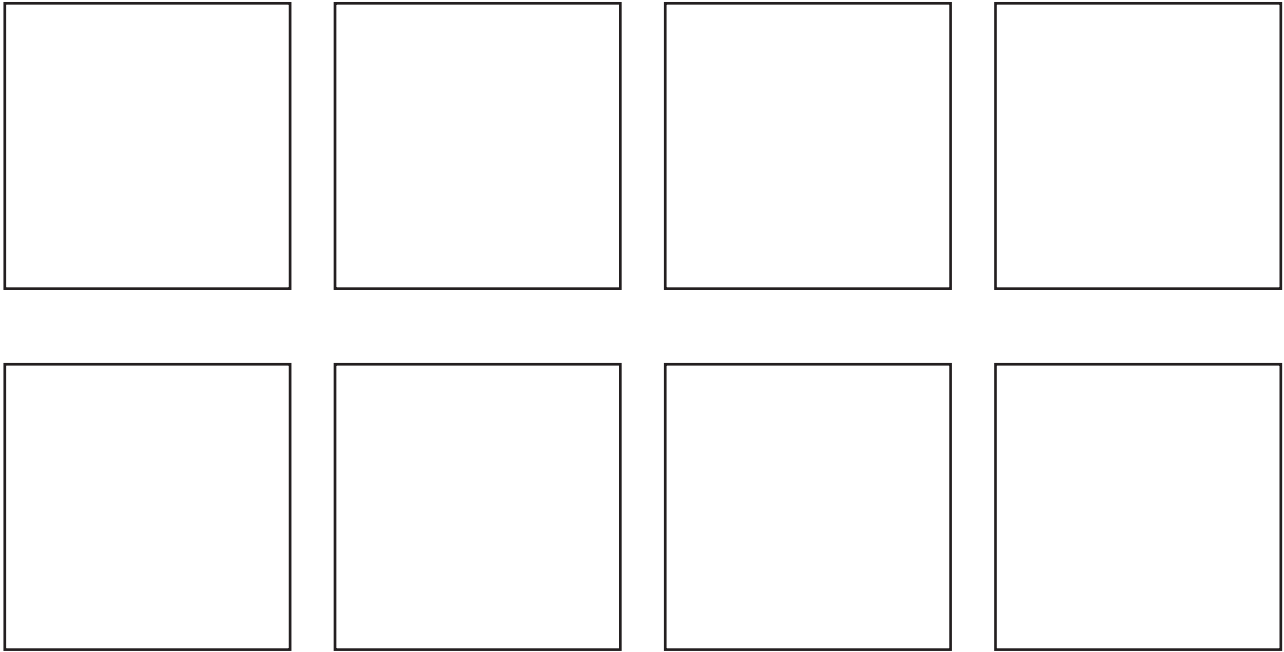
Tell the student: *"People often have to take a whole and divide it into equal parts and that we can learn to count these parts and do math calculations with them. We call parts of a whole 'fractions,' from a word that means 'to break.' You might know another similar word, 'fracture.' If you fracture your arm, you break a bone in your arm. Over the next few days you will be doing a number of activities to help you learn about doing math with fractions, the numbers we get when we break a whole into equal parts."*

Squares to Cut Out for Student Activities 1 and 2



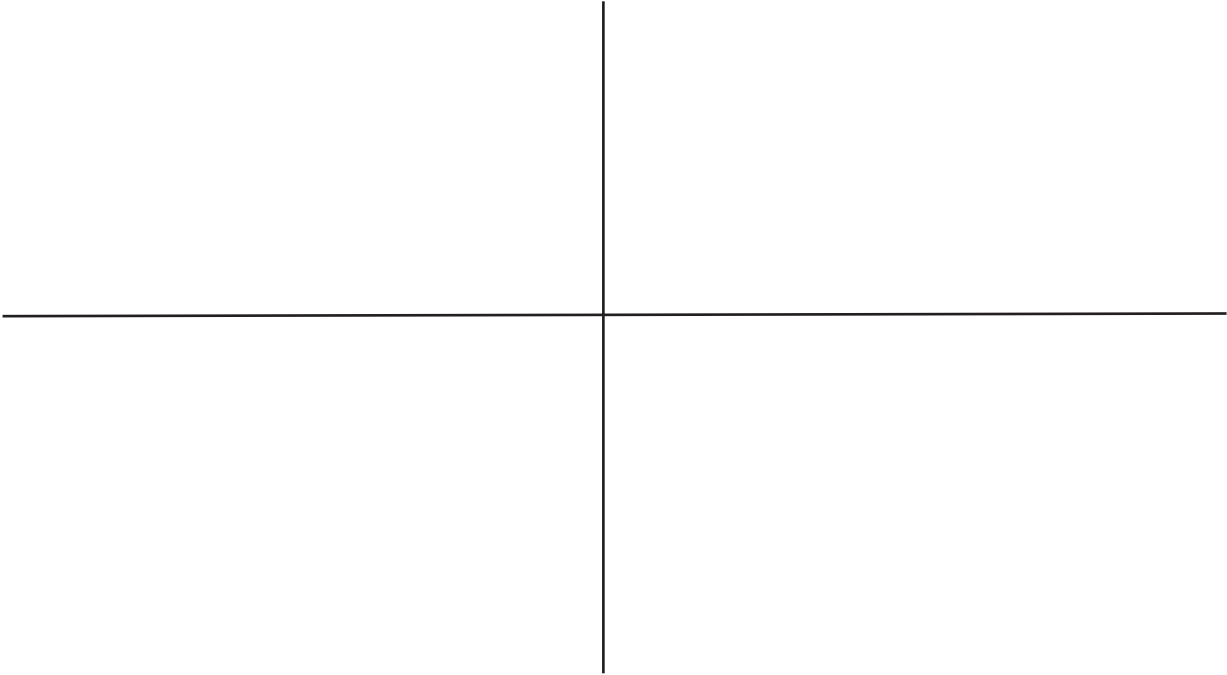
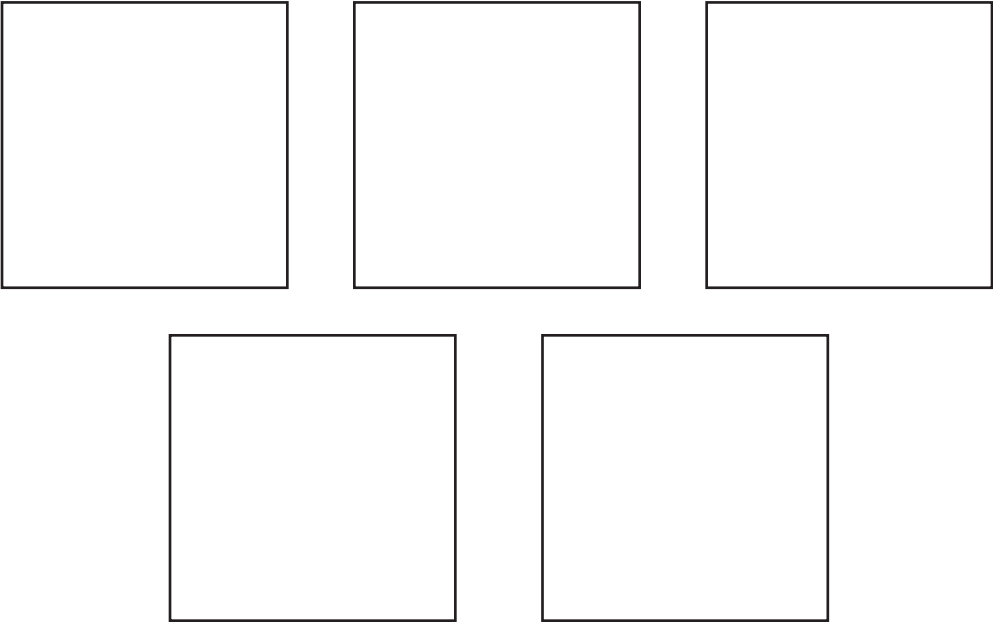
Student Activity 1

Your teacher will give you 8 squares like the ones below. Divide the squares into 4 equal groups.



Student Activity 2

Now take 5 squares like the ones below. Divide the 5 squares into 4 equal groups. How is this task different from dividing 8 squares into 4 equal groups?



Lesson 1 - Student Activities 3, 4, and 5

In the next activities, the student will be given a sheet with equal rectangles on them. She will divide them into a certain number of parts. For instance, in Student Activity 3, the student will divide each of the bars into 4 equal parts. Tell the student that there are many ways to divide something into equal parts, but the simplest way for these models is to use straight, up-and-down cuts. Demonstrate what you mean by using up-and-down cuts to divide one of her bars into 3 equal parts. Then erase these lines and have her divide the bars into 4 equal parts in the same way.

The student is then to shade in 1 of the parts. It is ideal if you have colored pencils for this task. Have the student select a colored pencil and show the student how to do a “sloppy” shade by making just a brief scribble in one of the parts. (You don’t want the student to spend too much time shading in a part.)

After she has shaded in one of the parts, say, “When we divide a whole into 4 equal parts, we call each part a fourth.” Write the word “fourth” on the paper and ask the student to repeat the word out loud. When we shade in one of the fourths, we say we have shaded in one fourth.” Put a numeral 1 in front of the word “fourth,” and have the student repeat “one fourth” out loud. Then say, “Here is how we write one fourth using just numbers.” Write $\frac{1}{4}$ on the appropriate line on the student sheet. Have the student copy the number and repeat the name out loud.

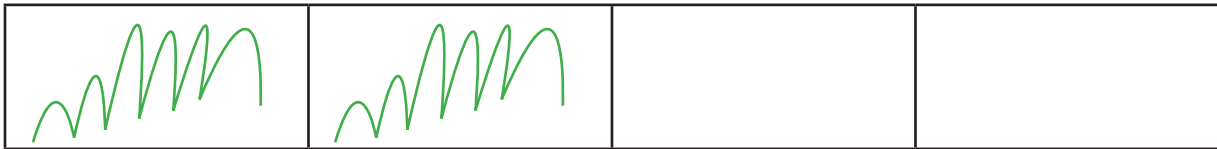
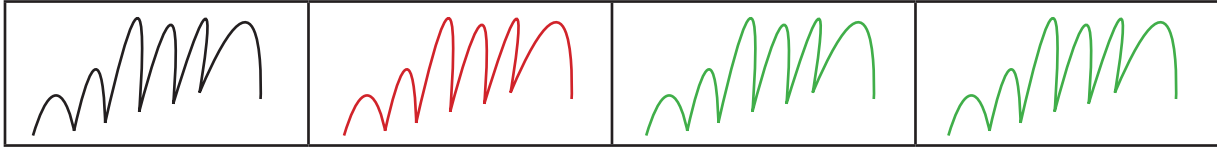
Continue having the student shade in parts as directed. It is useful to have her select a different color to shade it each subsequent amount. Ask her after she has shaded, “How many fourths altogether are shaded in now?” When she answers correctly, say, “*That’s right. You have now shaded two-fourths of a bar. Can you figure out how to write the number two-fourths?*” If the student has difficulties, write $\frac{2}{4}$ yourself and have her copy it and say it out loud.

Follow the same steps to complete Student Activities 4 and 5.

If the student has any difficulty reading the text, you should read it aloud for her.

Student Activity 3 (completed)

Each bar below represents 1 whole. Divide each bar into 4 equal parts.



Shade in 1 of the parts.

Record how much of a bar is shaded.

$$\frac{1}{4}$$

1 fourth

Shade in a second part.

Record how much of a bar is shaded.

$$\frac{2}{4}$$

Shade in four additional parts.

Record how much of a bar is shaded.

$$\frac{6}{4}$$

Student Activity 3

Each bar below represents 1 whole. Divide each bar into 4 equal parts.



Shade in 1 of the parts.

Record how much of a bar is shaded. _____

Shade in a second part.


Record how much of a bar is shaded. _____

Shade in four additional parts.

Record how much of a bar is shaded. _____

Student Activity 4

Each bar below represents 1 whole. Divide each bar into 6 equal parts.



Shade in 1 of the parts.

Record how much of a bar is shaded. _____

Shade in a second part.

Record how much of a bar is shaded. _____

Shade in four additional parts.

Record how much of a bar is shaded. _____

Student Activity 5

Each bar below represents 1 whole. Divide each bar into 10 equal parts.



Shade in 1 of the parts.

Record how much of a bar is shaded. _____

Shade in a second part.

Record how much of a bar is shaded. _____

Shade in four additional parts.

Record how much of a bar is shaded. _____

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LESSON 2

Lesson 2

In this lesson the student will continue the exercise begun in Lesson 1 and divide bars in specific ways, shade in some of the parts, and record how much of a bar is shaded in. Then students will then be given bars that are already shaded in and they will have to identify how much of a bar is shaded in.

If the student has any difficulty reading the text, you should read it aloud for her.

Student Activity 6

Each bar below represents 1 whole. Divide each bar into 6 equal parts.



Shade in 1 of the parts.

Record how much of a bar is shaded. _____

Shade in a second part.

Record how much of a bar is shaded. _____

Shade in four additional parts.

Record how much of a bar is shaded. _____

Shade in two more parts.

Record how much of a bar is shaded. _____

Student Activity 7

Each bar below represents 1 whole. Shade $\frac{5}{6}$ of a bar.



Each bar below represents 1 whole. Shade $\frac{9}{4}$ of a bar.



Student Activity 8

Each bar below represents 1 whole. Shade $\frac{1}{8}$ of a bar.

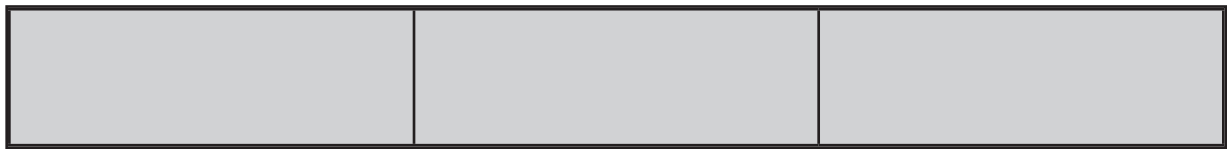


Each bar below represents 1 whole. Shade $\frac{17}{8}$ of a bar.



Student Activity 9

Each bar below represents 1 whole. How much of a bar is shaded. _



Each bar below represents 1 whole. Record how many bars are shaded. _____



Student Activity 10

Each bar below represents 1 whole. Record how much of a bar is shaded.



Each bar below represents 1 whole. Record how many bars are shaded.



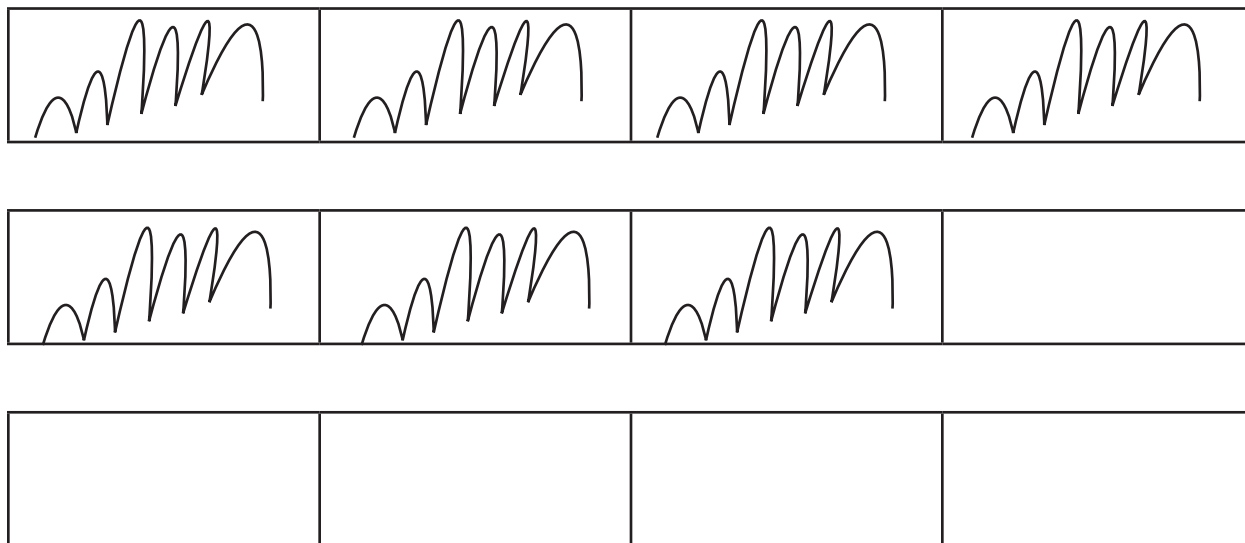
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LESSON 3

Lesson 3

In this lesson the student will do an activity called *Cut It Up*, and then do a short activity in which she has to identify what fractional part of a bar is shaded in.

In order for the student to do the *Cut It Up* activity, you will need to prepare two dice. On one die will be numerals, and on the others will be some fraction names, such as “fourths,” “sixths,” or “tenths.” Have the student roll the dice and then shade in the shapes on the record sheet on the facing page. Each bar represents 1 whole. For instance, if the student rolled 7 fourths, she would divide each bar into 4 equal parts and shade in 7 of the parts, as shown below.



ALTERNATE VERSION: The student may select from card decks to determine what amount to shade in. There is a template for such cards in the appendix.

After the student has played several rounds of the *Cut It Up* game, have her complete Student Activity 14, in which she has to identify how much is shaded in on some bars, a task she also did in Lesson 2.

Student Activity 11

Your teacher will show you how to play *Cut It Up*. Each bar represents 1 whole.

1. I rolled: _____

2. I rolled: _____

Student Activity 12

Your teacher will show you how to play *Cut It Up*. Each bar represents 1 whole.

1. I rolled: _____

2. I rolled: _____

Student Activity 13

Your teacher will show you how to play *Cut It Up*. Each bar represents 1 whole.

1. I rolled: _____

2. I rolled: _____

Student Activity 14

Each bar below represents 1 whole. Record how many bars are shaded.



Each bar below represents 1 whole. Record how much of a bar is shaded.



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LESSON 4

Lesson 4

Play the *Race to 1 Game* several times with your student.

How to Play the Race to 1 Game

Goal: To be the first player to make a fraction train the same length as the unit (1 whole) fraction tile. No overlapping tiles are allowed.

Rules:

1. Players take turns rolling a die labeled with fractions. The die faces should have:

$$\frac{1}{2} \quad \frac{1}{4} \quad \frac{1}{8} \quad \frac{1}{16}$$

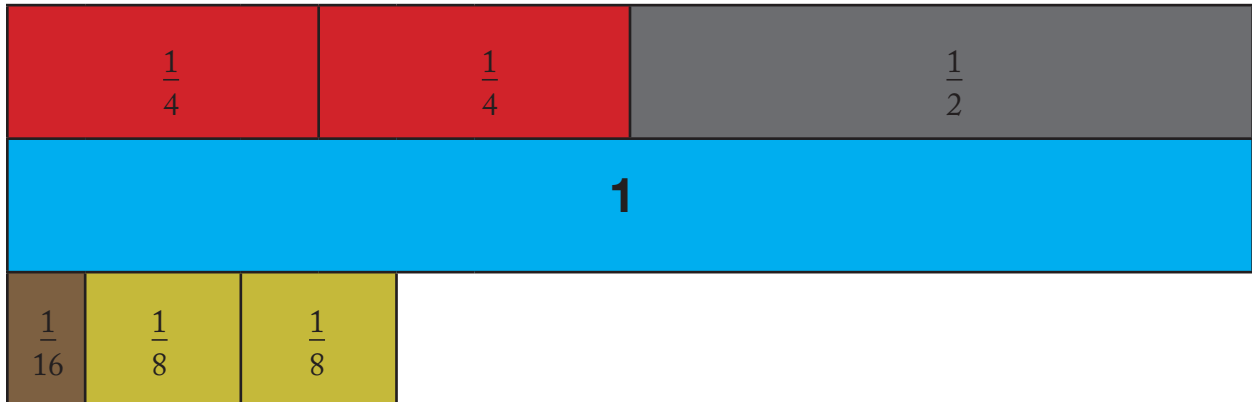
As an alternative to rolling dice, players can draw from a deck of cards that have these numbers on them. (A template for these cards is in the back of this book.)

2. The player places a fraction tile the size indicated by the die on his train. Players should build their trains directly on top or directly below of a unit (1 whole) fraction tile, as shown on the facing page. The left of the train should line up exactly with the left of the unit fraction tile. Players should add pieces to their train from left to right.


3. If a player rolls a number that would make her train longer than 1 whole, she forfeits her turn. To win, players must make a train that is exactly the same length as 1 whole.

4. Play continues until each player has made a fraction train equal to one whole. Players should record what fraction tiles they used to make their trains on the sheet on the next page. To record their fraction train, they should draw a model of the tiles they used and write an addition number sentence that matches the model. Additional record sheets can be found at the back of the appendix.


Examples of Race to 1



A sample game after 3 turns. Player 1 (on the top) has reached 1 whole, while Player 2 (on the bottom) still has a way to go. Below is an example of a completed record sheet.

Model: 

Number Sentence: $\frac{1}{4} + \frac{1}{4} + \frac{1}{2} = 1$

Model: 

Number Sentence: $\frac{1}{16} + \frac{1}{8} + \frac{1}{8} + \frac{1}{4} + \frac{1}{4} + \frac{1}{16} + \frac{1}{8} = 1$

Lesson 4 - continued

After the students have played two or three rounds of the game, point out that they can record their number sentences more easily if they combine fractions of the same type. For instance, in the number sentence: $\frac{1}{4} + \frac{1}{4} + \frac{1}{2} = 1$, there are two $\frac{1}{4}$ tiles represented, so they could record $\frac{1}{4} + \frac{1}{4}$ as $\frac{2}{4}$. And in the number sentence $\frac{1}{16} + \frac{1}{8} + \frac{1}{8} + \frac{1}{4} + \frac{1}{4} + \frac{1}{16} + \frac{1}{8} = 1$, the sixteenths, eighths, and fourths can each be combined and the whole number sentence could thus be recorded as: $\frac{2}{16} + \frac{3}{8} + \frac{2}{4} = 1$.

Questions to explore after playing the Race to 1 Game:

1. What is the fewest number of turns possible to reach 1 whole? _____
2. What is the largest number of turns possible to reach 1 whole? _____

Model:

Number Sentence:

Model:

Number Sentence:

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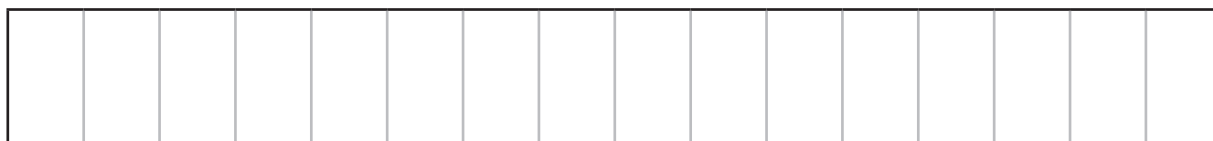
LESSON 5

LESSON 5

Continue playing the basic *Race to 1* game with your student, or try these variations.

Variation 1: Recording play on a new record sheet

Play is identical to that in the basic version. The only difference is how the students will record their play at the end of the round. Instead of drawing a model of the fraction tiles free-hand, students will record using the record sheet on the facing page. As you can see, the unit bar is represented as the long rectangle, and it has been divided into 16 equal parts.

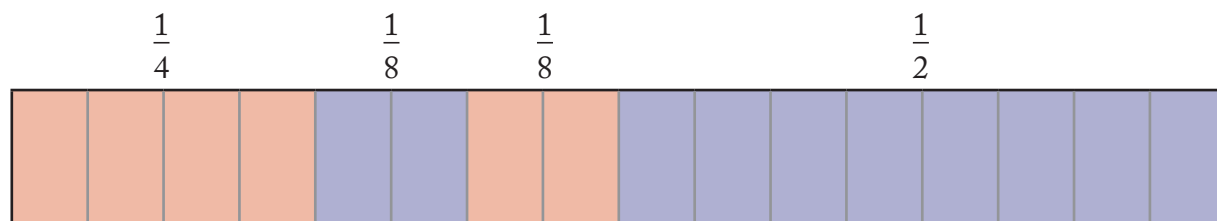


Tell the students that they will be recording their rolls on a new kind of record sheet. Show them the sheet and have them count the total number of little rectangles in the big rectangle.

Tell them that the big rectangle is 1 whole and then ask them how many of the little rectangles they would have to shade in to show $\frac{1}{2}$. Ask the same question about $\frac{1}{4}$, $\frac{1}{8}$ and $\frac{1}{16}$.

It is best if the students figure out these relationships on their own without the teacher telling them. Provide feedback as necessary to help them figure this out.

Students can now record their turns using a more precise model. They should shade in consecutive rolls using different colors. For example, if a student's equation is $\frac{1}{4} + \frac{1}{8} + \frac{1}{8} + \frac{1}{2}$, she should draw a model of this equation that looks like this:



Record Sheet for Race to 1 (Variation 1)

Number _____
Sentence: _____

Number _____
Sentence: _____

Variation 2: Race to 0

Goal: To be the first player to remove all the tiles on her train.

Rules:

1. Each player starts with a train constructed of exactly two $\frac{1}{2}$ tiles.

2. Players take turns rolling a die labeled with fractions. The same die is used for *Race to 1* as for *Race to 0*.

3. A player has three options on each turn:

- to remove a fraction tile (only if he has a piece the size indicated by the fraction face up on the die),
- to exchange any of the tiles left for equivalent pieces, or
- to do nothing and to pass die to the next player.

A player may not remove a piece and trade on the same turn, but can do only one or the other. It is important for players to check that others are making trades correctly.

Variation 3: Close to 1

Goal: To be the player to make a fraction train closest to 1 whole in six turns.

Rules:

1. Players take turns rolling a die labeled with fractions. The same die or cards are used for *Close to 1* as for *Race to 1*.
2. A player has two options each turn:
 - she can add the fraction tile indicated by her roll to her train, or
 - she can remove a fraction tile indicated by her roll from her train
3. Players should record their rolls on the accompanying record sheet. If a student adds a piece she should write the fraction preceded by a plus sign. If a student removes a piece, she should write a fraction preceded by a minus sign.
4. Each player gets exactly 6 turns. The winner is the player whose train is closest to 1 whole at the end of 6 turns.

There are no trades in this game. A player can remove a particular fraction tile only if it is already part of her train, but it can be anywhere on the train.

Trains may be longer than 1 whole. It is possible for the winning train to be longer than 1 whole.

It is also possible for trains to be less than 1 whole.

Players will have to discuss and agree at the end of 6 turns who has the train that is closest to 1 whole.

Variation 4: Race to 2

Goal: To be the first player to reach 2 on a fraction number line.

Rules:

1. Players take turns rolling a die labeled with fractions. The die faces should have:

$$\frac{1}{2} \quad \frac{1}{4} \quad \frac{1}{8} \quad \frac{1}{16}$$

As an alternative to rolling dice, players can draw from a deck of cards that have these numbers on them. (A template for these cards is in the back of this book.)

2. The player marks her roll on the record sheet on the facing page. Review with the student how many boxes to fill in to represent each fraction.

If the record sheet is placed in a plastic protector sheet, players can mark their turns using dry erase pens. It is ideal if each player alternates using 2 different colors when recording her rolls.

3. Play continues until each player has made a fraction train equal to 2 wholes.

Record Sheet for Race to 2

Player 1



0

1

2

Player 2



0

1

2

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LESSON 6

LESSON 6

In this lesson students will do an activity called, *You Have, You Want*. To perform the activity they will need the following fraction tiles:

$$\frac{1}{2} \quad \frac{1}{4} \quad \frac{1}{8} \quad \frac{1}{16}$$

Have the student read the first task. After the student has read the task, say, *“This says that you already have 1/4, so let’s put 1/4 on your workspace. Then it says that you want 1/2. Let’s put a 1/2 tile underneath the 1/4 tile and compare them. What tile do you need to add to your 1/4 train to make it exactly the same length as the 1/2 tile?”*

Have the student perform all these steps and record their answer on the line provided.

Have the student proceed in this way with the remaining questions.

If the student provides an answer with a correct value that contains the combination of 2 or more different fractions (such as $\frac{1}{16} + \frac{1}{8}$), tell her that she found a correct value but ask her also to find a value using just a single type of fraction tile.

Student Activity 15

You have $\frac{1}{4}$. You want $\frac{1}{2}$. How much more do you need? _____

Write an addition number sentence that matches your model.

You have $\frac{3}{8}$. You want $\frac{7}{16}$. How much more do you need? _____

Write an addition number sentence that matches your model.

You have $\frac{1}{2}$. You want $\frac{3}{4}$. How much more do you need? _____

Write an addition number sentence that matches your model.

Student Activity 16

You have $\frac{1}{16}$. You want $\frac{1}{4}$. How much more do you need? _____

Write an addition number sentence that matches your model.

You have $\frac{1}{2}$. You want $\frac{3}{4}$. How much more do you need? _____

Write an addition number sentence that matches your model.

You have $\frac{7}{16}$. You want $\frac{1}{2}$. How much more do you need? _____

Write an addition number sentence that matches your model.

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Appendices

Record Sheet for *Race to 1* (using fraction tiles)

Record Sheet for *Race to 1* (without using fraction tiles)

Record Sheet for *Cut It Up*

Record Sheet for *Race to 2*

Fraction Number Cards for *Cut It Up*

Fraction Tile Template

Model:

Number Sentence: _____

Model:

Number Sentence: _____

Record Sheet for *Race to 1* (without using fraction tiles)

Number _____
Sentence: _____

Number _____
Sentence: _____

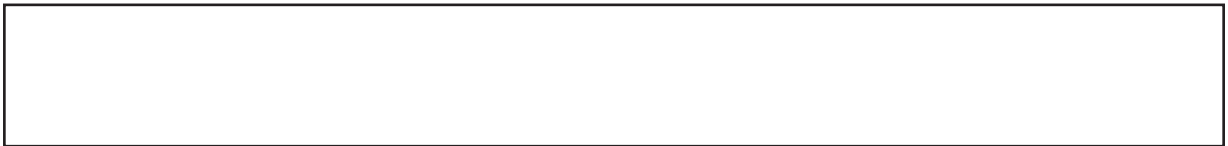
Record Sheet for *Cut it Up*

Each bar represents 1 whole.

I rolled: _____



I rolled: _____



Record Sheet for *Race to 2*

Player 1



0

1

2

Player 2



0

1

2

The number card sheets are meant to be printed out double-sided.

If possible, print the cards on card stock and laminate the sheet.

1	2	3	4
5	6	1	2
3	4	5	6
1	2	3	4
5	6	1	2

Number	Number	Number	Number
Number	Number	Number	Number
Number	Number	Number	Number
Number	Number	Number	Number
Number	Number	Number	Number

fourth(s)	sixth(s)	seventh(s)	eighth(s)
tenth(s)	fourth(s)	sixth(s)	seventh(s)
eighth(s)	tenth(s)	fourth(s)	sixth(s)
seventh(s)	eighth(s)	tenth(s)	fourth(s)
sixth(s)	seventh(s)	eighth(s)	tenth(s)

Name	Name	Name	Name
Name	Name	Name	Name
Name	Name	Name	Name
Name	Name	Name	Name
Name	Name	Name	Name

Print the fraction tiles on card stock, laminate the page, and place self-adhesive magnets on the back of each individual tile.

