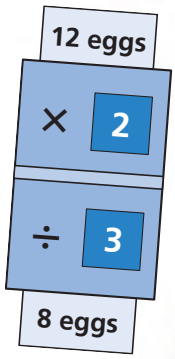
Chapter

11 Fraction Computation

Dear Student,



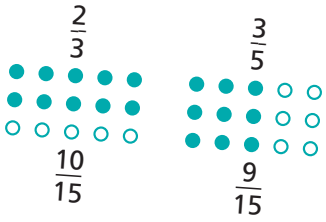
In this chapter, "Fraction Computation," you will use what you already know about fractions to learn to add, subtract, and multiply them.

The fraction machines that you used earlier can help you answer questions such as, "How many eggs are in $\frac{2}{3}$ of a dozen eggs?"

Multiplying $\frac{2}{3} \times 12$ is the same as finding $\frac{2}{3}$ of 12, so you already know something about multiplying with fractions! Also, "common sense" tells you that half of **two** thirds is **one** third. That is the same as saying $\frac{1}{2} \times \frac{2}{3} = \frac{1}{3}$ so there is something else you know about multiplying fractions.

You used **dot sketches** to help you find common denominators and compare fractions.

This process can also help you to add or subtract the fractions $\frac{2}{3}$ and $\frac{3}{5}$. Which is greater, $\frac{2}{3}$ or $\frac{3}{5}$? How much greater? What ideas do you have about how to add $\frac{2}{3}$ and $\frac{3}{5}$?



These examples show only a small fraction of the ideas you will learn as you begin to add, subtract, and multiply fractions!

Mathematically yours,

The authors of ***Think Math!***

THE WORLD ALMANAC FOR KIDS

Joy Ride

A carousel, or merry-go-round, is a popular ride at fairs and carnivals. The carousel in Bushnell Park, in Hartford, Connecticut, was built in 1914. The hand-carved and hand-painted horses swirl around under a 24-sided pavilion. For $1.00, you can ride the carousel for $3\frac{1}{2}$ minutes.

FACT·ACTIVITY 1

Use the information in the table about carousel horses to answer the questions.

1. What fraction of all the horses are the chariot horses?
2. What fraction are the jumpers and the standers altogether?
3. If $\frac{31}{48}$ of the total number of horses are jumpers, what fraction of the horses are standers?
4. Suppose $\frac{21}{48}$ of the horses are on the outer row of the carousel. What fraction of the horses are on the inner rows?
5. If you go on the ride twice, how many minutes will you ride in all?

Carousel Horses	
Type of Horse	**Number of Horses**
chariot	2
jumper	■
stander	■
Total	**48**

FACT ACTIVITY 2

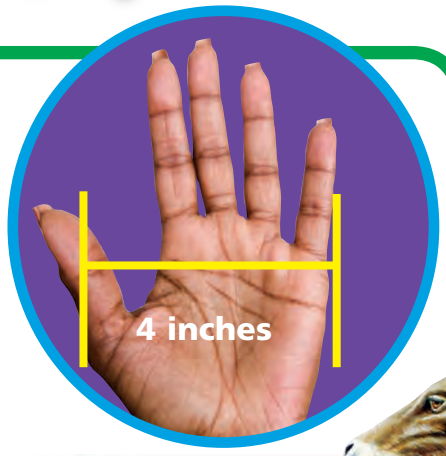
Our fascination with horses does not stop with carousel horses. Real horses can be much greater in size and weight than carousel horses. There are more than 200 breeds of horses in the world. The chart compares average heights and weights of different adult horse breeds.

Average Size of Horse Breeds		
Clydesdale	6 ft	1,800 lb
Thoroughbred	$5\frac{1}{3}$ ft	1,000 lb
Arabian	5 ft	900 lb
American Miniature	$2\frac{5}{6}$ ft	250 lb

1. How much taller is the Thoroughbred than the American Miniature?
2. Suppose a young Arabian foal gained $\frac{3}{4}$ lb, $\frac{7}{8}$ lb, and $\frac{15}{16}$ lb in 3 consecutive days. Find the total weight gain in the 3 days.
3. Which horse is $\frac{1}{4}$ the weight of a Thoroughbred?

CHAPTER PROJECT

A horse's size is often measured in hands. To measure by hands, one hand is placed on the ground and the other directly above it. The process is repeated by moving upward to the horse's shoulders. Work with a partner. How many hands tall are you? Use hands to estimate your height.



- Have a partner trace your outline.
- Let your body length be equal to one unit. Use hands to measure the length of your body based on the outline.
- If your body length is about 14 hand-lengths long, then a hand represents $\frac{1}{14}$ of your body length.
- Use this measure to estimate body lengths of objects in the classroom. Display the results on a poster and share with your class.

ALMANAC Fact

Horses are thought to be related to a prehistoric animal called Hyracotherium that lived 50 million years ago and was about the size of a fox!

Chapter 11

Lesson 2

REVIEW MODEL

Adding and Subtracting Fractions with Like Denominators

When adding or subtracting fractions with like denominators, you add or subtract the numerators, and then write the sum over the denominator. Sometimes you can simplify your answer.

Add. $\frac{3}{7} + \frac{4}{7}$

Step 1 Add the numerators.
$3 + 4 = 7$

Step 2 Write the sum of the numerators over the denominator.
$\frac{3}{7} + \frac{4}{7} = \frac{7}{7}$

Step 3 Write the fraction in simplest form.
$\frac{3}{7} + \frac{4}{7} = \frac{7}{7}$, or 1

Subtract. $\frac{5}{6} - \frac{1}{6}$

Step 1 Subtract the numerators.
$5 - 1 = 4$

Step 2 Write the difference of the numerators over the denominator.
$\frac{5}{6} - \frac{1}{6} = \frac{4}{6}$

Step 3 Write the fraction in simplest form.
$\frac{5}{6} - \frac{1}{6} = \frac{4}{6}$, or $\frac{2}{3}$

Example A

Add the numerators. $11 + 7 = 18$

Write $\frac{18}{15}$ as a mixed number.

$\frac{11}{15} + \frac{7}{15} = \frac{18}{15}$, or $1\frac{3}{15}$, or $1\frac{1}{5}$

Write in simplest form.

Example B

Subtract the whole-number parts. $6 - 2 = 4$

Subtract the numerators. $7 - 1 = 6$

$6\frac{7}{9} - 2\frac{1}{9} = 4\frac{6}{9}$, or $4\frac{2}{3}$

Write in simplest form.

Check for Understanding

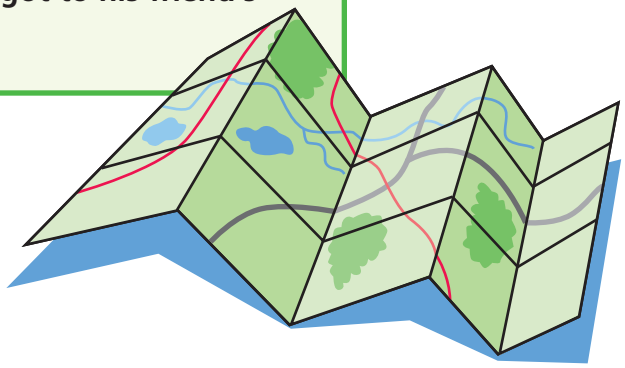
Find the sum or difference.

1. $\frac{3}{8} + \frac{3}{8}$
2. $\frac{13}{18} - \frac{7}{18}$
3. $\frac{8}{9} + \frac{7}{9}$
4. $5\frac{2}{3} - 1\frac{1}{3}$
5. $12\frac{3}{4} + 3\frac{1}{4}$
6. $\frac{17}{15} - \frac{2}{15}$
7. $4\frac{5}{6} + \frac{5}{6}$
8. $3\frac{11}{12} - \frac{5}{12}$

EXPLORE
Fraction Stories

1

After leaving home, Max drove $16\frac{7}{10}$ miles before stopping to buy gas. After driving another $14\frac{3}{10}$ miles, he got to his friend's home.

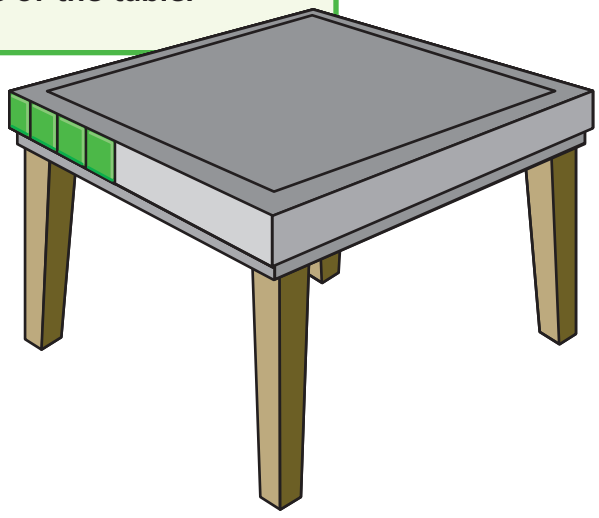


A How far did he travel from his home to his friend's home?

B What is the difference in distance between the two legs of the trip (before and after the gas station)?

2

Kristy measured a small rectangular table and found that it was $26\frac{3}{8}$ inches long and $16\frac{7}{8}$ inches wide. She plans to make a tile border around the edge of the table.



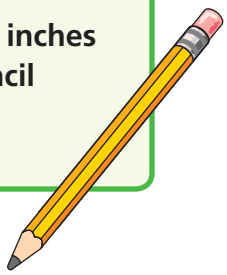
A What is the total distance around the edge of the table?

Chapter 11

Lesson 5

EXPLORE
Estimating Sums and Differences

1 **Eduardo's pencil measures $4\frac{7}{8}$ inches long, and his friend Yori's pencil measures $6\frac{1}{4}$ inches long.**



A Would you estimate the difference in lengths to be greater than 1 inch? Why?

B Would you estimate the difference in lengths to be greater than 2 inches? Why?

C About how much longer is Yori's pencil? How did you make your estimate?

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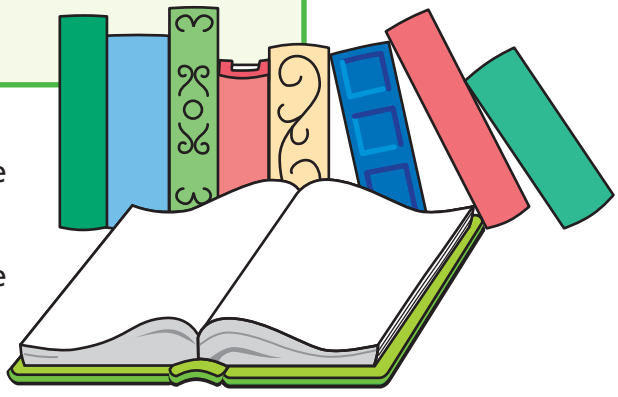
2 **Amy spent $1\frac{1}{2}$ hours on her reading homework and $1\frac{3}{4}$ hours on her science project.**



A Would you estimate that she spent more than 2 hours on this schoolwork? Why?

B Would you estimate that she spent more than 3 hours on this schoolwork? Why?

C About how many hours would you say she spent on this schoolwork?

Chapter 11

Lesson 6

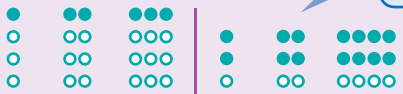
REVIEW MODEL
Adding and Subtracting Fractions with Unlike Denominators

When adding or subtracting fractions with unlike denominators, you first write the fractions with a common denominator. Then, you add or subtract the numerators. Sometimes you can simplify your answer.

Add. $\frac{1}{4} + \frac{2}{3}$

Step 1 Find a common denominator of 4 and 3.

You can use dot sketches to help you find a common denominator.



$\frac{1}{4} = \frac{2}{8} = \frac{3}{12}$ $\quad$ $\frac{2}{3} = \frac{4}{6} = \frac{8}{12}$

So, a common denominator of 4 and 3 is 12.

Step 2 Write equivalent fractions, using the common denominator.

$\frac{1}{4} + \frac{2}{3} = \frac{3}{12} + \frac{8}{12}$

Step 3 Add the numerators. Write the sum over the denominator.

$\frac{1}{4} + \frac{2}{3} = \frac{3}{12} + \frac{8}{12} = \frac{11}{12}$

Subtract. $\frac{3}{5} - \frac{1}{3}$

Step 1 Find a common denominator of 5 and 3.

$\frac{3}{5} = \frac{6}{10} = \frac{9}{15}$ $\quad$ $\frac{1}{3} = \frac{2}{6} = \frac{3}{9} = \frac{4}{12} = \frac{5}{15}$

So, a common denominator of 5 and 3 is 15.

Step 2 Write equivalent fractions, using the common denominator.

$\frac{3}{5} - \frac{1}{3} = \frac{9}{15} - \frac{5}{15}$

Step 3 Subtract the numerators. Write the difference over the denominator.

$\frac{3}{5} - \frac{1}{3} = \frac{9}{15} - \frac{5}{15} = \frac{4}{15}$

Example A

$1\frac{5}{6} + 2\frac{3}{4} = 1\frac{10}{12} - 2\frac{9}{12} = 3\frac{19}{12}$ or $4\frac{7}{12}$

Example B

$5\frac{1}{2} - 1\frac{1}{3} = 5\frac{3}{6} - 1\frac{2}{6} = 4\frac{1}{6}$

Check for Understanding

Find the sum or difference.

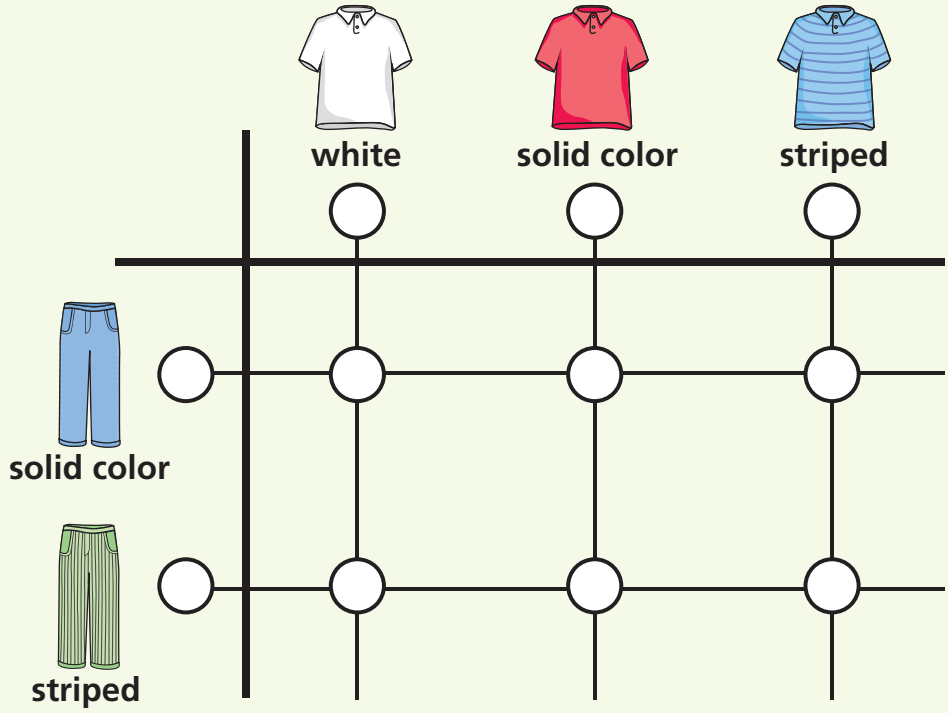
1. $\frac{1}{6} + \frac{2}{3}$
2. $\frac{8}{9} - \frac{1}{2}$
3. $3\frac{3}{4} + 2\frac{2}{3}$
4. $5\frac{4}{5} - 1\frac{1}{3}$

Chapter 11

Lesson 8

EXPLORE
Combinations

1 Dillion used model to show different combinations of shirts and pants.



A Two-thirds of the shirts have no stripes.

B One-half of the pants have no stripes.

C What fraction of all possible outfits have no stripes?

---

2 Make a model to show the possible combinations of eye color (brown, blue, hazel, green, gray) and hair color (blond, black, brown).

Use your model to answer these questions:

A How many combinations have brown eyes, but not brown hair?

B What fraction of all possible combinations have brown eyes, but not brown hair?

Chapter 11

Lesson 8

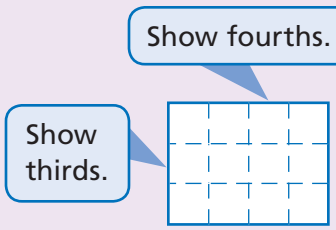
REVIEW MODEL
Multiplying Fractions

To multiply fractions you can shade a rectangle or use dot sketches to help you find the product. Sometimes you can simplify your answer. Find $\frac{3}{4} \times \frac{2}{3}$.

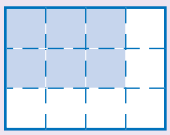
One Way

Use a rectangle.

Step 1 Draw a rectangle for $\frac{3}{4} \times \frac{2}{3}$.



Step 2 Shade an area that is $\frac{3}{4}$ by $\frac{2}{3}$.



Step 3 $\frac{6}{12}$ of the rectangle is shaded.

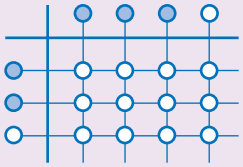
So, $\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$, or $\frac{1}{2}$.

Write in simplest form.

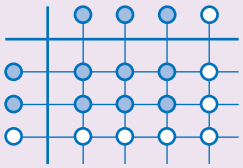
Another Way

Use a dot sketch.

Step 1 Draw a dot sketch for $\frac{3}{4} \times \frac{2}{3}$.



Step 2 Shade the dots where the lines for the shaded dots intersect.



Step 3 $\frac{6}{12}$ of the dots at the intersections are shaded.

So, $\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$, or $\frac{1}{2}$.

Write in simplest form.

A Third Way

Compute.

Multiply the numerators. $\frac{3}{4} \times \frac{2}{3} = \frac{3 \times 2}{} = \frac{6}{}$

Multiply the denominators. $\frac{3}{4} \times \frac{2}{3} = \frac{3 \times 2}{4 \times 3} = \frac{6}{12}$ or $\frac{1}{2}$

Write in simplest form.

Check for Understanding

Find the product.

1. $\frac{1}{4} \times \frac{2}{5}$
2. $\frac{1}{2} \times \frac{3}{4}$
3. $\frac{5}{6} \times \frac{3}{8}$
4. $\frac{3}{10} \times \frac{1}{3}$

Chapter 11

Lesson 11

REVIEW MODEL

Problem Solving Strategy

Solve a Simpler problem

Heather and Dylan both moved into a new neighborhood in the past year. Heather has lived in her new house for $\frac{1}{6}$ of the year and Dylan has lived in his new house for $\frac{3}{4}$ of the year. How much longer has Dylan lived in his new neighborhood?

Strategy: Solve a Simpler Problem

Read to Understand

What do you know from reading the problem?

Heather has lived in her new house for $\frac{1}{6}$ of the year. Dylan has lived in his new house for $\frac{3}{4}$ of the year.

What do you need to find out?

how much longer Dylan has lived in his new neighborhood

Plan

How can you solve this problem?

You can *solve a simpler problem* by finding common denominators for the two fractions and then subtracting one from the other.

Solve

How can you solve a simpler problem?

You can find a common denominator for $\frac{1}{6}$ and $\frac{3}{4}$. Both fractions have a common denominator of 12. $\frac{1}{6}$ is equivalent to $\frac{2}{12}$ and $\frac{3}{4}$ is equivalent to $\frac{9}{12}$. $\frac{9}{12} - \frac{2}{12} = \frac{7}{12}$

So, Dylan has lived in his new neighborhood for $\frac{7}{12}$ of a year longer than Heather.

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 *solve a simpler problem* to solve.

1. Christine measured the amount of rain that fell on the weekend. On Saturday, $\frac{2}{3}$ inch fell and on Sunday $\frac{1}{4}$ inch fell. What was the difference in the amount of rain that fell on Saturday and Sunday?

2. Taylor is preparing for a bicycle race. He rode his bike 14 miles each day for 21 days. How many total miles did he ride?

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 an Equation

Mixed Strategy Practice

Use any strategy to solve. Explain.

3. Morgan wrote the following clues for a Mystery Number Puzzle. I am a 2-digit multiple of 3. I am even. The sum of my digits is a 2-digit number. I am less than 50. What number am I?

4. Patrick is making a display with some books. The first row has 1 book, the second row has 4 books, the third row has 9 books, and the fourth row has 16 books. If the pattern continues, how many books will be in the sixth row?

5. Austin has a collection of 36 baseball cards. He decided to give $\frac{1}{3}$ of them to his brother, Peter. He also gave $\frac{1}{4}$ of his cards to his sister, Deanna. Austin kept the rest. How many cards does each sibling have?

6. On Monday, Charmaine walked 8 blocks east from her house to go to school. After school she walked 4 blocks south to the library, and then 6 blocks west to the store. She walked 4 blocks north to her friend's house before she walked back home. How many blocks in all did Charmaine walk on Monday?

For 7–9, use the table.

7. Richard hands the cashier three $20 bills. How much change will he get back if he buys a helmet and a set of 4 wheels?

8. How much does it cost to buy the skateboard and the skateboard ramp?

9. Stephanie is saving $20 a week to buy a skateboard and elbow pads. How many weeks will she need to save before she can buy the items?

Skateboard Items for Sale

Item	Cost
Skateboard	$49.99
Skateboard ramp	$39.95
Elbow pads	$19.99
Helmet	$29.95
Set of 4 wheels	$17.50

Chapter 11 Vocabulary

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

1. If several fractions represent length in inches, they have a(n) ___?___.
2. The product of two fractions is called a(n) ___?___.
3. Two fractions that have the same denominator are fractions with a(n) ___?___.
4. A number that has a whole number and a fraction is a(n) ___?___.
5. If a fraction is greater than 1, it is called a(n) ___?___.
6. Two fractions that have the same value are ___?___.
7. The number below the bar of a fraction is the ___?___.
8. The number above the bar of a fraction is the ___?___.
9. The places where two lines cross in a dot sketch are called the ___?___.
10. A(n) ___?___ is a rectangle in which the lengths of the sides represent the factors in a multiplication problem.

Word List A

- area model
- common denominator
- common unit
- denominator
- dot sketch
- equivalent fractions
- fraction of a fraction
- fraction of a set
- improper fraction
- intersections
- least common denominator
- mixed number
- numerator
- unlike denominators

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

11. Less than one is to proper fraction as greater than one is to ___?___.
12. North America is to the equator as ___?___ is to the fraction bar.

Word List B

- area model
- denominator
- mixed number
- numerator

Talk Math

Discuss with a partner what you have just learned about fractions. Use the vocabulary terms *numerator, denominator,* and *fraction.*

13. How can you add two fractions with unlike denominators?
14. How can you subtract mixed numbers with like denominators?

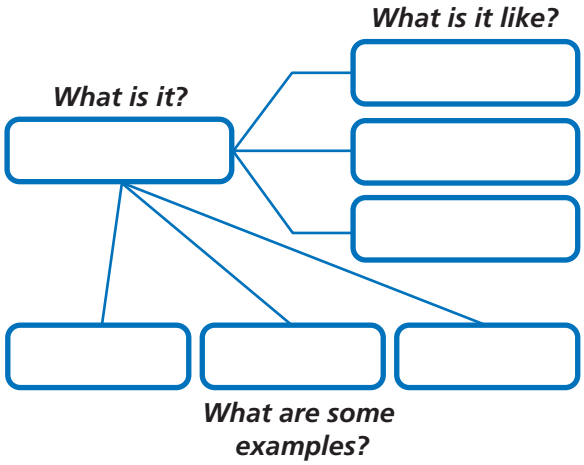
Word Definition Map

15 **Create a word definition map for the word *mixed number.***

A What is it?

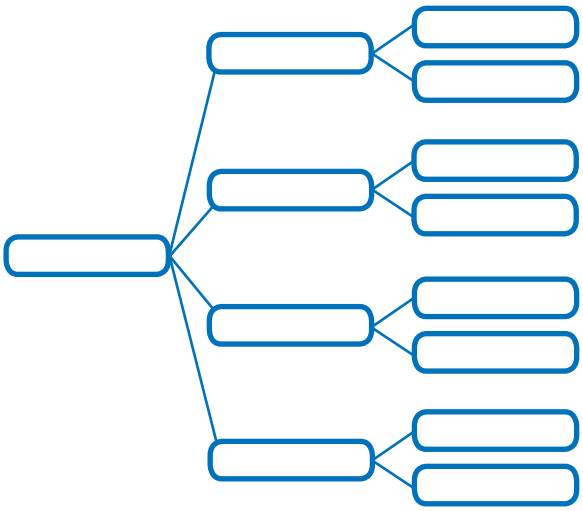
B What is it like?

C What are some examples?



Tree Diagram

16 **Create a tree diagram for the concept of *multiplying fractions.* Use what you know and what you have learned about multiplication and fractions.**



INTERSECTIONS *Intersections* are crossroads. A crossroad is the point where two or more roads cross each other. When you stand in a crossroad, you are standing on two roads at the same time. Line *intersections* are used to model multiplication of whole numbers and of fractions. The point where the lines cross—the *intersection*—is the solution to the problem. The solution is part of both lines, in much the same way as a person standing in a crossroad is part of both roads.

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GAME

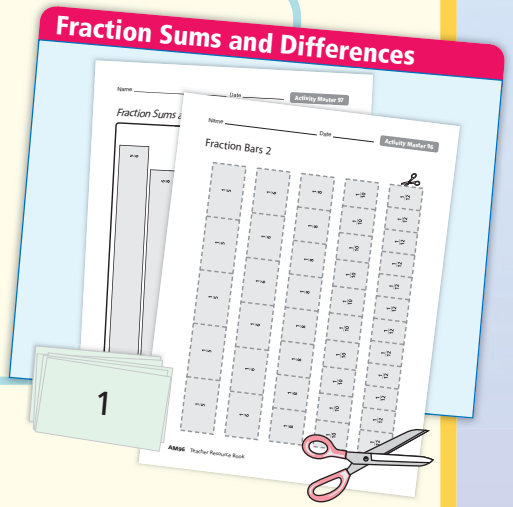
Fraction Sums and Differences

Game Purpose

To practice adding and subtracting fractions with like denominators

Materials

- Activity Masters 95–96: Fraction Bars 1–2
- Activity Master 97: *Fraction Sums and Differences* Game Board
- Scissors, Index cards



How To Play The Game

1. Play this game with a partner. Each player will need cut-out fraction bars from Activity Masters 95 and 96. Use the index cards to make two sets of number cards, 1 to 12. The object of the game is to match the sums and differences of two fractions to the different fractions on your game board.

2. Mix up the number cards, and place them face-down in a stack. Decide who will go first, and then take turns.

3. Pick three number cards. Choose one of the numbers—but not 1—to be the denominator of two fractions. The other numbers will be the numerators.
   - Add or subtract the two fractions. Try to make one of the fractions represented by a bar on your game board.
   - If you can make one of the fractions shown on the game board, explain how you can add or subtract to make that fraction. Then use the fraction bar pieces to check whether the sum or difference matches the length of the bar on the game board. (You might need to share fraction tiles with your partner.)
   - If your match is successful, trace the pieces onto the game board bar as a visual record. Put a check mark in the box to the left of the bar on the game board. Write the number sentence on the bar.
   - Once a bar is used, it may not be used again.

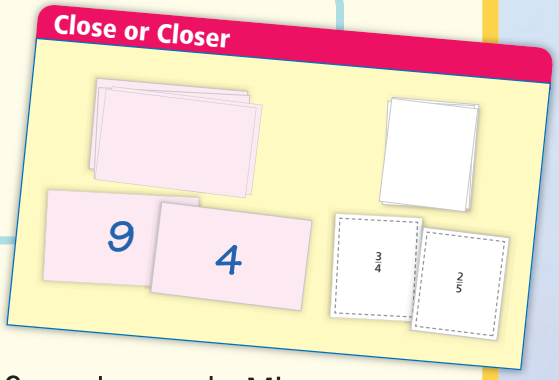
4. Play until the number cards run out. The one with more check marks wins.

GAME

Close or Closer

Game Purpose
To practice finding fractions of a set

Materials
- Activity Master 27: Fraction Cards 1
- Index Cards, Scissors



How To Play The Game

1. This is a game for 2 players. Make a set of 1–9 number cards. Mix them up, and put them face down in a stack. Cut out the Fraction Cards. Mix them up, and put them face down in another stack. Each fraction card refers to that fraction of 120. So, for example, the $\frac{3}{4}$ card means $\frac{3}{4}$ of 120, or 90.

2. Take turns being the dealer. The dealer turns over two number cards to make a 2-digit target number. Then the dealer turns over two fraction cards and leaves them on the table.

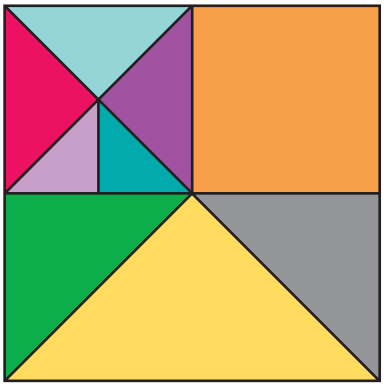
3. Take turns choosing one of the face-up fraction cards. The player who is **not** the dealer goes first. Each time you remove a fraction card from the table, replace it with another fraction card from the stack. There are always 2 face-up fraction cards on the table.
   - You may have only 1 or 2 fraction cards in your hand at any time. Before choosing a third fraction card, discard one of your others.
   - Find the number that the fraction of 120 on your fraction cards equals so you can find how close you are to the target number. You can add or subtract the two fractions and find that part of 120. Or you can find the two individual fraction parts of 120 first and then add or subtract those amounts.
   - If you are happy with your fraction cards, you may pass and not choose another card. However, if you pass, you may not choose another fraction card for the rest of the game.

4. Play until both players have passed or until there are no more fraction cards left in the stack. Whoever has the number closer to the target number wins!

CHALLENGE

Fractions of Areas

Use the figure below. It has an area of 1 square unit.



1. Use logical reasoning and what you know about geometric figures to write the fraction of the figure represented by each color.

2. What fraction of the figure does each of the following represent?

   A Light Blue + Red

   B Orange + Green

   C Light Blue + Orange

   D Red + Blue + Green

   E Orange + Green + Yellow

3. Suppose the figure were a piece of metal that was worth exactly $500. What would be the value of each of the following?

   A Yellow

   B Light Blue

   C Orange + Green

4. Suppose the figure had an area of 2 square units. Which answers above, if any, would change? Explain your reasoning.