

Computation with Fractions



Grades 4–6

Using AIT Products

- *Mathemedia*, program 5, “Fractions”
- *Math Works*, program 11, “Adding and Subtracting Fractions and Mixed Numbers with Like Denominators”
- *Math Works*, program 20, “Adding and Subtracting Fractions and Mixed Numbers with Unlike Denominators”
- *Math @ Work*, program 4, “Weather: A Whirlwind of Numbers”

Overview

We live in a mathematical world. Whenever we cook, buy something from the store, play music, or tell time, we have to rely on mathematical understanding. Therefore, it is important for students to connect mathematical concepts to their daily lives and learn to recognize and apply mathematics in contexts outside of mathematics. In this lesson students explore fractions and develop strategies for computing with fractions. Students will then apply what they have learned about fractions while gathering and analyzing weather data.

Objectives

- Define the term *fraction*, and identify real-life situations in which people use fractions.
- Add and subtract fractions and mixed numbers with like (or common) denominators.

- Add and subtract fractions and mixed numbers with unlike (or different) denominators.
- Apply knowledge of fractions while solving real-life mathematical problems.
- Examine how meteorologists use mathematical calculations to make predictions and track and evaluate severe weather.

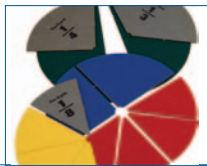
Vocabulary

common denominator
denominator
fraction
improper fraction
mixed number
numerator
least common multiple

Preparation

Materials Needed

- one dime
- one sheet of music
- measuring cups
- AIT video *Mathemedia*, Program 5, “Fractions” (first 4 minutes)
- math manipulatives, such as fraction bars, fraction circles, fraction tiles, base blocks
- AIT video *Math Works*, program 11, “Adding and Subtracting Fractions and Mixed Numbers with Like Denominators”—Cue the tape to approximate time code 8:51
- AIT video *Math Works*, program 20, “Adding and Subtracting Fractions and Mixed Numbers with Unlike Denominators”—Cue the tape to approximate time code 8:25
- AIT video *Math @ Work*, program 4, “Weather: A Whirlwind of Numbers” (first 5 minutes)
- four rulers
- four empty milk cartons



“For the things of this world cannot be made known without a knowledge of mathematics.”

—Roger Bacon

Planning Notes

Arrange students in work groups to complete the activity on Days Two and Three. Groups of four to six are best.

Time

This project will take about four 45-minute class periods, in addition to homework and extension activity time.

Procedure—Day 1

Review: Fractions

Show students a dime, a sheet of music, and a measuring cup. Ask students what these items have in common. Explain to students that in order to use these items, people must rely on their knowledge of *fractions*. Review the meaning of the term fractions. Make sure that students understand that a fraction is a number that represents an equal part of a whole. Fractions are written as “ $\frac{a}{b}$.” The top number is called the *numerator*. It represents the part of the whole that is being counted. The bottom number is called the *denominator*. It represents the total number of parts the whole is divided into. Coins are fractional parts of a dollar. A dime is one-tenth of a dollar. One [1] is the numerator, and 10 is the denominator.

Have students describe situations in which they have had to use fractions. Tell students that fractions are used in most daily activities and in the workplace. People work with fractions when they cook, buy something from the store, play music, or tell time.

Video

Prepare students for watching the AIT video from *Mathemedia* by asking them if they have followed a recipe while cooking. Allow students to share their experiences. Explain that most recipes list measurements in fractions.

Show students “You’re Cookin’,” Part A of Mathemedia Program 5. Stop the video after the on-screen questions appear. Give students several minutes to try to calculate the answers to the questions on the screen. Then have student volunteers share their answers with the class and explain how they obtained the answer.

Students should have followed these steps:

1. 12×8 ounces = 96 ounces
2. If 8 ounces = $\frac{1}{2}$ pound, then 96 ounces = 12 half pounds ($96 \div 8$)
3. 12 half pounds = 6 pounds

Some students may convert half pounds to whole pounds at step 2, as follows:

2. If 8 ounces = $\frac{1}{2}$ pound, then 16 ounces = 1 pound
3. $96 \div 16 = 6$ pounds

Introduce New Topic: Adding and Subtracting Fractions with Common Denominators

Ask students how they would solve this problem: If a recipe for cake calls for $\frac{1}{3}$ cup of milk, and a recipe for frosting calls for an additional $\frac{1}{3}$ cup of milk—how much milk do you need to make the cake and frosting? Allow students to describe how they would solve this problem.

Explain that in order to solve this problem, you need to know how to add fractions.

Write the following steps on the board.

1. Add or subtract the numerators. The sum or difference is the numerator of your answer.
2. Use the same denominator for the denominator of your answer.

3. If possible, change your answer to a mixed number and/or reduce your answer.

As a class, find the sum of $\frac{1}{3}$ and $\frac{1}{3}$. Then find the difference of $\frac{3}{4}$ and $\frac{1}{4}$.

Homework

Have students write down the steps for adding and subtracting fractions with common denominators. Then give each student a copy of the “Find the Sum or Difference” worksheet (Appendix A) and ask students to complete the worksheet for homework.

Procedure—Day 2

Review

Go over the “Find the Sum or Difference” worksheet with students. Make sure students have a clear understanding of how to add and subtract fractions with common denominators.

Introduce New Topic: Adding and Subtracting Fractions with Different Denominators

Divide the class into small groups. Then pose the following question: “Suppose you want to bake an apple cobbler. You need $\frac{1}{4}$ cup of flour for the filling and $\frac{2}{3}$ cup of flour for the crust. How much flour do you need all together?” Invite students to use manipulatives such as fraction bars to find a solution. Discuss the methods used to find an answer to this problem.

Explain to students that you must add $\frac{1}{4}$ and $\frac{2}{3}$ to solve this problem. Since the denominators are different, you cannot find the answer by merely adding the numerators.

Video

Cue program 20 from the series *Math Works* to approximate time code 8:25 (the beginning of the animation).

Tell students that they will now watch a cartoon about a family of fractions. Ask students to take notes during the cartoon and write down the steps for adding and subtracting fractions with unlike denominators. Then play the video.

After the video, ask students the following questions:

- Why did the Fraction Family think they could not add themselves together?
- According to the Fruit Family, what did the Fraction Family need to do to add and subtract each other?
- How do you change two fractions with unlike denominators to fractions with common denominators?

Group Work

In the video, the Fruit Family told the Fraction Family that they all had different ways they could be written and still be the same value; therefore, they could find common denominators. Explain to students that in order to add or subtract two fractions with different denominators, you must first rewrite the fractions so that they DO have the same denominator.

Write the following steps on the board:

1. Find the least common multiple of the denominators. This is the common denominator.
2. Rewrite the fractions as equivalent fractions with the common denominator.
3. Add or subtract the numerators. The sum or difference is the numerator of your answer.
4. Use the same denominator for the denominator of your answer.

5. If possible, change your answer to a mixed number and/or reduce.

Go over each step, and show students how to find the sum of $\frac{1}{4}$ and $\frac{2}{3}$.

1. The multiples of a number are the string of numbers that result when you “count by” that number. For example: The multiples of 5 are the numbers that result when you “count by” 5: 5, 10, 15, 20, etc. . . . Have students name the first six multiples of 4. Write these multiples on the board. Have students name the first six multiples of 3. Write these multiples on the board. Then circle the smallest multiple that the two have in common. Explain that this will be the common denominator.

2. Rewrite $\frac{1}{4}$ and $\frac{2}{3}$ so they have a common denominator. To do so, multiply the numerator and denominator of each fraction by the number that changes its denominator to the common multiple:

$$\frac{1}{4}: \text{ Multiply by 3, since } 4 \times 3 = 12$$

$$\frac{1 \times 3}{4 \times 3} = \frac{3}{12}$$

$$\frac{2}{3}: \text{ Multiply by 4, since } 3 \times 4 = 12$$

$$\frac{2 \times 4}{3 \times 4} = \frac{8}{12}$$

3. Add the numerators. $3 + 8 = 11$
4. Use 12 as the denominator, since that is the common denominator. $\frac{1}{4} + \frac{2}{3} = \frac{11}{12}$

Divide the class into four groups. Assign each group one of the following problems.

- $\frac{1}{2} + \frac{2}{5} =$
- $\frac{2}{9} - \frac{1}{6} =$
- $\frac{14}{15} - \frac{5}{6} =$
- $\frac{1}{2} - \frac{3}{11} =$

Allow a few minutes for students to solve the problems. Then have one person from each group explain to the class how to solve the problem.

Homework

Have students write down the steps for adding and subtracting fractions with common denominators. Then give each student a copy of the “Dressing the Salad” worksheet (Appendix B) and ask students to complete the worksheet for homework.

Procedure—Day 3

Review

Go over the “Dressing the Salad” worksheet with students. Make sure students have a clear understanding of how to add and subtract fractions with unlike denominators.

Introduce New Topic: Adding and Subtracting Mixed Numbers

Divide the class into small groups. Then pose the following question: “Suppose you bought $6\frac{3}{4}$ pounds of ground beef. You used $1\frac{1}{4}$ pounds of ground beef to make tacos. Now you want to make meatloaf. The recipe calls for $5\frac{1}{2}$ pounds of ground beef. Do you have enough ground beef to make meatloaf?” Invite students to use manipulatives such as fraction bars to find a solution. Discuss the methods used to find an answer to this problem.

Explain to students that you must subtract $1\frac{1}{4}$ from $6\frac{3}{4}$ to solve this problem.

Once you know how to add and subtract fractions, it is easy to add and subtract mixed numbers. To do so, follow these steps:

1. Add or subtract the fractional parts. Keep in mind that the denominators in the fractional part have to be the same before you can add or subtract them. The sum or difference is the fractional part in your answer.

2. Add or subtract the whole numbers. The sum or difference is the whole number part in your answer.
3. If possible, reduce the fractional parts, or convert the improper fraction to a mixed number.

Go over each step, and show students how to find the difference of $6\frac{3}{4}$ and $1\frac{1}{4}$.

1. Subtract $\frac{1}{4}$ from $\frac{3}{4}$.

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

2. Subtract 1 from 6.

$$6 - 1 = 5$$

3. Reduce the fraction.

$$\frac{2}{4} = \frac{1}{2}$$

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

Divide the class into four groups. Assign each group one of the following problems.

- $5\frac{2}{3} + 2\frac{1}{5} =$
- $5\frac{1}{4} - 3\frac{1}{8} =$
- $4\frac{1}{5} + 3\frac{4}{5} =$
- $2\frac{1}{12} - 1\frac{5}{6} =$

Allow a few minutes for students to solve the problems. Then have one person from each group explain to the class how to solve the problem.

Video

Cue program 11 from the series *Math Works* to approximate time code 8:51 (the beginning of the animation).

Tell students that they will now watch a cartoon about a merchant and a pieman who use fractions while working. Ask students to take notes during the cartoon and write down the steps for adding and subtracting mixed numbers. Then play the video.

After the video, ask students the following questions:

- How does the merchant subtract fractions?
- How did the pieman rename the mixed numbers?

Group Work

Have students use the pieman's method to rename $2\frac{1}{4}$. Students should first draw the picture, then figure out the new mixed number. Ask a student volunteer to show the class how he or she renamed $2\frac{1}{4}$.

Explain to students that the merchant's problem is not uncommon. Oftentimes, when you subtract mixed numbers, the numerator of the fractional part you are subtracting from is too small. When this happens, you have to regroup the numbers you are subtracting from. Then you can subtract as you normally would.

Pose the following question to students: "The pieman has $3\frac{2}{6}$ blueberry pies. He sold $1\frac{5}{6}$ pies. How much did he have left?" Give students several minutes to solve this problem. Then show students how to solve this problem by writing down the steps on the board.

1. Rename $3\frac{2}{6}$.

$$3\frac{2}{6} = 2\frac{8}{6}$$

2. Subtract the fractions.

$$\frac{8}{6} - \frac{5}{6} = \frac{3}{6}$$

3. Subtract the whole numbers.

$$2 - 1 = 1$$

4. Reduce the fraction.

$$\frac{3}{6} = \frac{1}{2}$$

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

Homework

Ask students to look through some cookbooks and write two word problems based on the recipes in the cookbook. Explain to students that they will be exchanging their problems with other students.

Procedure—Day 4

Review

Have students exchange the word problems they wrote for homework. Give students a few minutes to solve each other's problems. Then have the student who wrote the problem check if the other student solved the problem correctly.

Previewing Activity

Prior to showing the video, get a copy of the weather section from your local newspaper. Then read the weather forecast for the week. Ask your students to describe how they think meteorologists develop forecasts. Have your students explain how math may be used to forecast weather.

Video

Play the first six minutes of program 4 from the series *Math @ Work*.

Tell students that in this video five meteorologists give a behind-the-scenes tour of the National Weather Service in Wilmington, Ohio, and WDTN Channel 2 in Dayton, Ohio. The meteorologists explain how mathematical calculations are used to make predictions as well as to track and evaluate severe weather.

After the video, ask students the following questions:

- How do meteorologists develop forecasts?
- How is math involved in weather forecasting?

Group Work

Divide the class into groups. Explain to students that they will track the amount of rainfall their area receives in one month and compare this with other cities across the nation.

Have each group make a rain gauge. You will need a flat bottomed, flat sided container (an empty gallon milk carton will work) and a ruler.

Instructions for the rain gauge:

- Cut off the top and discard that part of the container.
- Place it outside in an area that is open and away from trees, awnings, or overhangs so that snow (or rain) can fall freely into the container.
- Put it outside in advance of rainfall (or snowfall).

After a rainfall:

- Put a ruler inside the container to measure the rain.
- Mark the date, the number of inches of rain, and the number of centimeters of rain. Record this data in a table.

Students should continue this process for one month. At the end of the month, students should calculate the average monthly rainfall in inches and centimeters.

Ask students to go online or to call the local bureau of the National Weather Service or the local television station and find out what the average rainfall was for each of the last three years. Have students find out how their numbers compare with the data provided by the professionals.

Ask students to choose three other cities across the nation and find out what the average rainfall was for the last month. Have students compare the rainfall in the local area with the rainfall in the three cities. Students can create a graph to show how rainfall in the four areas compare.

Assessment

1. Individual Assessment

Write the following problems on the board. $\frac{3}{6} + \frac{4}{6}$, $\frac{2}{3} - \frac{7}{12}$, $1\frac{1}{5} + 2\frac{1}{3}$, and $5\frac{1}{4} - 2\frac{3}{4}$. Then ask students to write and explain all the steps involved in finding the sum or difference.

2. Writing Assignment

Have students write a paper that describes three common activities that require people to use their knowledge of fractions.

Extension Activity: Working with Fractions

Ask students to interview an adult and find out how he or she uses fractions at work and at home. Then have students create a diary that describes the adult's typical day and explains how he or she uses fractions.

Resources

Harcourt School Publisher's—The Learning Site

www.harcourtschool.com/index.html

This Web site offers online tutorials, activities, and games. The activities and games listed below relate specifically to fractions.

Add Fractions

www.harcourtschool.com/activity/show_me/e535.htm

Watch this interactive demonstration to learn more about adding fractions.

Add Like Fractions

www.harcourtschool.com/activity/rubber_add_like_fractions

Match fractions and their sums to get a colorful surprise!

Grade 4, Adding Unlike Fractions

www.harcourtschool.com/activity/elab2004/gr4/10.html

Use a model to add unlike fractions.

Grade 5, Adding Unlike Fractions

www.harcourtschool.com/activity/elab2004/gr5/11.html

Use a model to add unlike fractions.

Grade 6, Addition and Subtraction of Unlike Fractions

www.harcourtschool.com/activity/elab2004/gr6/4.html

Use a tool to find the least common multiple to add unlike fractions.

Math Jingles: How Easy Is That?

www.harcourtschool.com/jingles/jingles_all/35how_easy_is_that.html

Learn about adding and subtracting fractions as you listen to and follow along with the math jingle, “How Easy Is That?”

Subtract Fractions

www.harcourtschool.com/activity/show_me/e536.htm

Watch this interactive demonstration to learn more about subtracting fractions.

Grade 4, Subtracting Like Fractions

www.harcourtschool.com/activity/elab2004/gr4/9.html

Add and subtract like fractions to make a magic circle.

Grade 4, Subtracting Unlike Fractions

www.harcourtschool.com/activity/elab2004/gr4/11.html

Use a model to subtract unlike fractions.

Grade 5, Subtracting Unlike Fractions

www.harcourtschool.com/activity/elab2004/gr5/12.html

Use a model to subtract unlike fractions.

A Tour of Fractions

<http://mathforum.org/paths/fractions>

A Tour of Fractions was created by The Math Forum at Drexel University. This Web site includes links to teacher materials and resources and answers to frequently asked questions about fractions.

Cynthia Lanus's—Who Wants Pizza?

<http://math.rice.edu/~lanus/fractions/index.html>

The “Who Wants Pizza?” activities are designed to introduce fractions in a concept-building way. The activities can be done on computers with Internet access with square grid paper printed out and used along with the electronic images.

Visual Fractions

www.visualfractions.com

Visual Fractions is an on-line tutorial that offers instruction and practice in identifying, renaming, and operating on fractions. All examples are modeled with number lines or circles.

AAA Math—Fractions

www.aaamath.com/B/fra.htm

The AAA Math Web site includes an online explanation of fractions, as well as interactive games that require students to apply their knowledge of fractions.

Funbrain.com—Soccer Shootout

www.funbrain.com/fractop/index.html

This Web site was created by Pearson Education. It includes interactive games that enable students to practice adding and subtracting fractions.

Appendix A: Find the Sum or Difference

Directions: Find each sum or difference. Make sure your answers are in lowest terms.

1. $\frac{1}{8} + \frac{3}{8} =$

2. $\frac{2}{9} + \frac{5}{9} =$

3. $\frac{9}{16} - \frac{5}{16} =$

4. $\frac{8}{15} - \frac{10}{15} =$

5. $\frac{2}{7} + \frac{4}{7} =$

6. $\frac{9}{10} - \frac{4}{10} =$

7. $\frac{13}{20} - \frac{7}{20} =$

8. $\frac{1}{3} + \frac{2}{3} =$

9. $\frac{7}{12} - \frac{5}{12} =$

10. $\frac{1}{2} + \frac{1}{2} =$

Appendix B: Dressing the Salad

Directions: Solve each problem. Make sure your answers are in lowest terms.

1. A recipe for citrus salad dressing calls for $\frac{1}{3}$ cup of lemon juice and $\frac{3}{4}$ cup of orange juice. How much juice do you need all together?
2. Josh has $\frac{1}{4}$ cup of Italian salad dressing. He used $\frac{1}{8}$ cup of dressing. How much salad dressing does he have left?
3. Sarah wants to make Amish coleslaw and Homestyle coleslaw. The recipe for Amish coleslaw calls for $\frac{1}{4}$ cup of mayonnaise, and the recipe for Homestyle coleslaw calls for $\frac{2}{3}$ cup of mayonnaise. How much mayonnaise does Sarah need for both recipes?
4. Kyle had $\frac{2}{3}$ teaspoons of oregano. He used $\frac{1}{4}$ teaspoon of oregano for his dinner last night. Now he wants to make Greek salad dressing. The recipe calls for $\frac{1}{2}$ teaspoon of oregano. Does he have enough oregano?