

# Balancing the Scales:

## Understanding Ratios



Grades 5-8

Using AIT Products

- *Math Works*, program 27, "Ratio: Forming Ratios"
- *It's a Gas: Math & Science of the Blimp*, program 3, "Ratio and Proportion"
- *Mathemedia*, program 8, "Ratios"

### Overview

Ratios appear all around you, often in disguise. If you scan a newspaper, you may read a story that states, "Four out of 10 American Voters Approve of the Way the President is Handling His Job." Or, you may see statistics that show that a baseball player has a batting average of .300. This means that the player has made 30 base hits for every 100 times at bat. The weather report may say that there is a 60% (or 6 in 10) chance of rain. In fact, all percentages, fractions, and decimals can be described as ratios.

This lesson is designed to enhance students' understanding of ratios and develop their proportional reasoning skills. Students will discover how people apply ratios and proportions in everyday situations while developing a recipe for party mix using ratios, calculating the height of objects around the school, and figuring out distances on a road map.

### Objectives

- Explain the concept of ratio.
- Represent comparisons of numbers as ratios.
- Use ratios and proportional reasoning to solve problems.
- Read and interpret map scales and calculate map distances.



Numbers are the highest degree of knowledge. It is knowledge itself.

—Plato

## Vocabulary

proportion  
ratio  
scale

## Preparation

### Materials needed

- AIT video: *Math Works*, Program 27, “Ratio: Forming Ratios”
- Large bowls
- Measuring tape
- AIT video: *It’s a Gas: Math & Science of the Blimp*, Program 3, “Ratio and Proportion”
- Picture of one wall in your classroom
- AIT video: *Mathemedia*, Program 8, “Ratios”
- Road maps

## Planning Notes

Arrange students in work groups to complete this lesson. Groups of three to five are best.

### Time

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

## Procedure—Day 1

### Advance Preparation

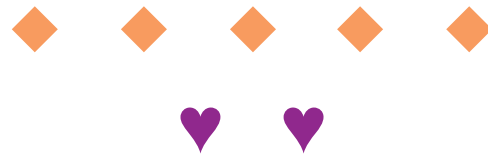
Prior to class, ask students to bring in their favorite dry snack to share with the class. For example, students may bring cereal, pretzels, nuts, marshmallows, or M & M’s®.

### Introduce New Topic

Explain to students that they will be learning how to describe the relationship between two quantities.

As a class, brainstorm various ways the students can be classified into groups (for example, gender, hair color, or eye color). Create a list on the board and write the number of students that fit into each category.

Tell students that you can use ratios to describe groups. A ratio is a comparison of two amounts. Draw the picture below on the board.



Explain to students that the ratio of diamonds to hearts is 5 to 2.

### Video

Cue program 27 from the series *Math Works* to approximate time code 00:06:27 (when the host starts talking). Tell students that they will watch a video that explains how to write ratios. Ask students to write down the different ways to write ratios. Then play the video until approximate time code 00:07:15.

After the video, review the different ways to write ratios. Have students use ratios to compare the different groups of students. Encourage students to write the ratios in different forms.

Facilitate a discussion around the following question: In a ratio, is the lesser quantity or number always written first? Make sure that students understand that the numbers in a ratio represent specific items. For example, the ratio of diamonds to hearts can be written as: 5:2,  $5/2$ , or 5 to 2. However, it would be incorrect to say that 5 hearts to 2 circles represents the same thing.

Cue program 27 from the series *Math Works* to approximate time code 00:10:03 (the beginning of the animation). Tell students that they will now watch a video about a man who has a hard time understanding ratios. Then play the video until approximate time code 00:12:43 (the end of the animation).

After the video, ask students the following questions:

- The Pied Piper thought the going rate for rat-catching was three dollars for one rat, but the mayor's rate was three rats for one dollar. What is the difference?
- What did Farmer George tell the Piper to ask himself to avoid mistakes?

### Group Work

Have students work in groups to create a recipe for party mix. The recipe should use ratios, such as the number of cups of pretzels to cups of cereal. Give each group a large bowl and allow students to use the dry snacks they brought in to make their recipe. If time permits, allow groups to share their party mix with the rest of the class. Students can then take a survey to see which recipe they like best and compare the ratios in their favorite recipe with the ratios in the recipe they liked the least.

## Procedure—Day 2

### Introduce New Topic

Take students outside and find a flagpole (NOTE: Make sure it is a sunny day and you can see shadows.) Divide the class into groups and give each group a tape measure. Explain to students that they need to determine the height of the flagpole using the tape measure and other materials if you have them.

Invite each group to share their solutions to the problem and explain how they got it. Discuss the legitimacy of the solutions.

### Video

Tell students that they will now watch a video in which a girl uses her knowledge of ratio to calculate the actual size of the Goodyear Blimp. Cue program 3 from the series *It's a Gas: Math & Science of the Blimp* to approximate time code 00:00:53 (the beginning of the video). Play the video until approximate time code 00:06:04 (the end of the interview).

After the video, ask the following questions:

- How did Trista and Abby figure out the dimensions of the blimp?
- What is the difference between ratio and proportion?
- How can you use ratio and proportion to determine the height of the flagpole?

### Group Work

Take the class outside again. Measure the height and shadow of one student. Measure the shadow of the flagpole. Then have students use ratio and proportions to determine the height of the flagpole.

Ask students to work in groups to determine the height of three other objects. For example, students can determine the height of a tree or a swing set.

Allow groups to share their measurements with the class and describe how they obtained those measurements.

### Homework

Explain to students that a photograph usually isn't the same size as the actual object. Give each student a picture of one of the walls in your classroom. Then write the actual size of one of

the objects shown in the picture on the board and have students write this on the back of their pictures. For homework, have students determine the size of two other objects in the picture.

Invite each group to describe how they calculated the size of the object.

Have students work in groups. Give each group a picture of one of the walls in your classroom and a ruler. Then write the actual size of one of the objects shown in the picture on the board.

## Procedure—Day 3

### Introduce New Topic

Invite students to describe how they calculated the actual size of the objects in the classroom.

Explain to students that the objects in the photograph have been scaled down. Scale is the ratio that compares the size of an object in a photograph or drawing to the size of an actual object.

Scales are also seen on road maps. Scales give people the information they need to figure out how far apart two locations are or how long it might take to drive from one location to the other.



Mathematics compares the most diverse phenomena and discovers the secret analogies that unite them.

—Joseph Fourier

### Video

Tell students that they will now watch a video in which two students use a map and its scale to decide whether they can drive more than 100 miles in  $2\frac{1}{2}$  hours. Cue program 8 from the series *Mathemedia* to approximate time code 00:12:53. Pause the video at approximate time code 00:15:12 (when the narrator finishes reading the question). Have students work in groups to answer the question. Give them time to work and then ask volunteers for their answers. Restart the video to see solution to the problem.

### Group Work

Give each group a road map of the surrounding area. Have students calculate the distance between the school and three other locations.

### Assessment

#### Individual Assessment

Write the following problems on the board and ask students to solve each problem.

- A recipe for lemonade calls for the juice of 8 lemons and 1 cup of sugar for each lemonade. What is the ratio of lemons to sugar? If you make 10 gallons of lemonade, how many lemons will you need? How much sugar will you need?
- A parking meter allows 15 minutes of parking for 10 cents. What is the ratio of minutes to cents? How much will it cost to park next to the parking meter for one hour?

### Writing Assignment

Give each student a road map and have him or her plan a trip. Students should write a paragraph that states where they are going, how far they are going to travel, and how long it will take to drive there. The paragraph should also describe how they calculated the distance and travel time.

## Extension Activity

Now that students have been introduced to the concept of scale, have them create a drawing made to scale. Ask each student to choose one wall of a room in his or her home and measure objects on and around that wall. After measuring the objects, they should choose a scale factor, make note of the scale factor, and draw the objects to scale on a piece of graph paper. Students should write the original measurements of the objects on a separate piece of paper. Once students have completed their drawings, divide the class into pairs. Tell students to keep their lists of actual measurements to themselves and exchange their drawings with their partners. Each partner should create a list of actual measurements by looking only at the scaled-down drawing.

## Resources

### Cynthia Lanius's All about Ratios: Teachers' Page

[math.rice.edu/~lanius/proportions/proptea.html](http://math.rice.edu/~lanius/proportions/proptea.html)

Have students apply their knowledge of ratios while completing the online activities and quizzes available from this Web site.

### The Math Forum @ Drexel— Ask Doctor Math: Ratio and Proportion

[mathforum.org/library/drmath/sets/mid\\_ratio.html](http://mathforum.org/library/drmath/sets/mid_ratio.html)

Teachers and students can visit this Web site to find answers to commonly asked questions about ratios.

### National Council of Teachers of Mathematics—Illuminations

[illuminations.nctm.org](http://illuminations.nctm.org)

Explore this Web site to find lesson plans, online activities, and links to Web sites designed to help teachers understand and apply the National Council of Teachers of Mathematics (NCTM) Principles and Standards for School Mathematics.

### Tips for Teachers: How to Access AIT Materials without Spending Your Own Nickel(s)

[www.ait.net/technos/e-zine/tech\\_notes/grants.php](http://www.ait.net/technos/e-zine/tech_notes/grants.php)