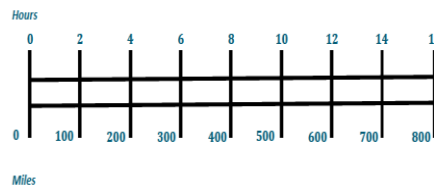


### Ratios and Unit Rates

In this 29-lesson module, students are introduced to ratios and rates and use ratio language and notation to solve real-world problems. Students will explore tape diagrams, double number line diagrams, ratio tables, equations, and the coordinate plane to develop deep understanding, enabling them to become proficient and confident mathematicians in middle school.

### One Model Seen in the Module:

The Double Number Line Diagram



### Key Words

**Ratio:** A pair of nonnegative numbers,  $A:B$ , where both are not zero, and describes a relationship between the quantities.

**Rate:** Indicates how many units of one quantity there are for every 1 unit of the second quantity.

**Unit Rate:** The numeric value of the rate, e.g. in the rate 2.5 mph, the unit rate is 2.5.

**Rate unit:** The unit of measure of the rate. (e.g. in the rate 2.5 mph, the rate unit is miles per hour)

**Equivalent Ratios:** Ratios that have the same value.

**Percent:** Percent of a quantity is a rate per 100.

**Associated Ratios:** Ratios that are related, e.g. if the ratio of the number of boys to the number of girls is 1:2, we can also determine the ratio of the number of girls to the total number of children is 2:3. We can further determine the ratio of the number of girls to the number of boys is 2:1.

**Double Number Line Diagrams:** A math model that is often used when quantities have different units and is a visual representation for showing multiple equivalent ratios.

**Ratio Table:** A table listing pairs of numbers that represent equivalent ratios.

**Tape Diagrams:** Drawings that look like a segment of tape, used to illustrate number relationships. Also known as strip diagrams, bar model, fraction strip, or length model.

### One Model Seen in the Module:

The Ratio Table

| Number of Cups of Sugar | Number of Cups of Flour |
|-------------------------|-------------------------|
| 2                       | 3                       |
| 4                       | 6                       |
| 6                       | 9                       |

### What Came Before this Module:

In Grade 5, students studied multiplicative comparisons, which is the foundation for their understanding of comparing quantities in a ratio relationship. In addition, students worked to develop fluency in operations with whole numbers, fractions, and decimals.

### What Comes After this Module:

Students will divide fractions using various strategies and arithmetic operations.

### How can you help at home?

- ✓ Ask your child what they learned in school today and ask them to show you an example.
- ✓ Reinforce fast recall of multiplication and division facts by playing math games using flashcards. See how many facts your child can answer in 20 seconds. Then, see if they can answer more questions the next time by playing again!

### Key Common Core Standards:

#### Understand ratio concepts and use ratio reasoning to solve problems.

- Use ratio language to describe the relationship between two quantities.
- Use rate language in the context of a ratio relationship.
- Solve real-world problems using ratio and rate reasoning.

Below is an example of how your child can use a tape diagram to solve a problem in this module.

Your middle school has 900 students.  $\frac{1}{3}$  of the students bring their lunch instead of buying lunch at school. What is the value of the ratio of the number of students who do bring their lunch to the number of students who do not?



300 students bring lunch    600 students buy lunch

First, I created a tape diagram. In the tape diagram,  $\frac{1}{3}$  of the students bring their lunch instead of buying lunch at school. I determined that 300 students bring their lunch, leaving 600 students who buy their lunch. One unit of the tape diagram represents 300, and 2 units of the tape diagram represent 600. This creates a ratio of 1:2. As such, the value of the ratio of the number of students who bring their lunch to the number of students who buy their lunch is  $\frac{1}{2}$ .

## Model in the Spotlight!

### Tape Diagrams

There are several models used in *A Story of Ratios* that will foster deep knowledge of important concepts in middle school mathematics.

In Module 1, students develop fluency and flexibility in their ability to reason using rates and ratios because they are exposed to multiple real-life scenarios where they use ratio thinking to reach a solution. Students use multiple tools (e.g. tape diagrams, double number line diagrams, ratio tables, equations and coordinate planes) to guide their thinking and encourage them to develop true meaning of ratios and rates in order to apply this knowledge to various situations. Students continue building their understanding by finding the percent of a quantity as a rate per 100 and determining the whole when given a part and the percent.

Although each of these tools may be used for different types of problems, they all have a similar goal of helping students develop their thinking in a concrete way (manipulating something that physically exists) so they experience a direct connection between the models and math symbols and are able to solve problems abstractly. In *A Story of Ratios*, students will use the proportional reasoning skills they develop in this module to propel them into success in the modules yet to come!

Below is an example of how you can use the double number line diagram to help solve a problem typically seen in Module 1.

Suppose you want to determine how many pages of homework Megan will complete in 8 hours if she can complete 3 pages in 2 hours, assuming she completes the homework at a constant rate.

You can represent the situation using a double number line diagram to visibly show the ratio relationship of 3 pages for every 2 hours. If you extend the double number line diagram, you can see that in 8 hours, Megan will complete 12 pages of homework.

