Solving Practical Problems Using Proportional Reasoning I

STRAND: Computation and Estimation

STRAND CONCEPT: Practical Applications-Rational Numbers and Proportional Reasoning

SOL 7.3, 8.4

Remediation Plan Summary

Students use ratio tables and proportions to solve practical problems. This lesson covers the basics of proportions and sets the framework for the following lessons.

Common Misconceptions

- Students may mix up the whole and the part when trying to write the proportion for the practical problem.
- Students may incorrectly set up the proportions by always putting the variable as the numerator in the second ratio or over 100.

Materials

- Ratio Tables handout

Introductory Activity

Tell students that to make lemonade from a frozen concentrate, the directions say to add 3 cups of water to the concentrate and stir. *What would happen if you were to add 4 cups of water? How would the lemonade taste?* (Adding more water means it would be overly diluted and would taste weak.) *What if you were to add only 2 cups of water?* (It would taste too strong.) Have the students talk about the relationship between the water and the concentrate.

Display the following table and ask students to help you determine the missing measurements.

Concentrate	1	2			7
Water	3		9	15	

Explain that this is proportional reasoning and they will be exploring this concept today.

Plan for Instruction

1. Distribute the "Ratio Tables" worksheet. Read the first problem with the class, clarifying any misunderstandings. Have students complete the first table.

2. Ask students for the missing the ratio table entries, and have them check and correct their entries as needed. Then, explain that the ratio of cases to bottles is 1 to 15, which is also written 1:15 or $\frac{1}{15}$. The ratio table shows other ratios, e.g., 2:30, 3:45, and 4:60. Demonstrate that the relationship between any two ratios from the ratio table can be written as a proportion, for example, $\frac{1}{15} = \frac{4}{60}$. Give the definition of *proportion*. Ask students to complete

the proportion $\dfrac{1}{15} = \dfrac{6}{x}$ by using the data in the ratio table.

($\dfrac{1}{15} = \dfrac{6}{90}$) If more examples are needed, use other data from the ratio table.

3. Have them explore how many bottles are in 10 cases. Have students explain their strategy. (Students may double the quantity in 5 cases, multiply 10 and 15 or use a proportion.) Ask them how many bottles would be in 22 cases. (For this problem, students may extend the values in the ratio table or use a proportion.)

4. Once students understand the above concept, point out that in a proportion, like quantities, i.e., those with a common property, are always placed in the *same position* of the ratios. In this example, number of cases is on the top (numerator) and number of bottles is on the bottom (denominator). Explain that once the proportion is written, a special relationship exists that enables you to find other values. For example, for the proportion $\dfrac{1}{15} = \dfrac{2}{30}$, the special relationship can be found by using a process called "cross products." Cross products is

multiplying the numerator of one ratio by the denominator of the other ratio: $\dfrac{1}{15} \diagup\!\!\!\!\diagdown \dfrac{2}{30}$

$1 \times 30 = 2 \times 15 = 30$.

5. Repeat step 3, using another proportion, e.g., $\dfrac{1}{15} = \dfrac{4}{60}$, from the ratio table:

$\dfrac{1}{15} = \dfrac{4}{60}$; $1 \times 60 = 4 \times 15 = 60$. This relationship exists whenever there is a proportion.

6. Tell students that the ratio table established the special relationship for this problem. Now that this relationship is known, it is possible to solve other problems. For example, a store owner wants to purchase 225 bottles of water from Camps, Inc., a supplier of mineral water. How many cases should she order? We know 1 case = 15 bottles, and we want to know *n* cases = 225 bottles. The proportion is $\dfrac{1}{15} = \dfrac{n}{225}$. Using cross multiplication, $1 \times 225 = 15 \times n$, or $225 = 15n$.

To solve this equation, divide both sides by 15, which is the number multiplied by *n*. The answer is 15 cases. Have the students check to make sure the multiplication works: substitute 15 for *n* in the proportion and cross multiply.

($\dfrac{1}{15} = \dfrac{15}{225}$; $1 \times 225 = 15 \times 15 = 225$. The answer is correct.)

7. Have students complete the "Movie Tickets" ratio table and then answer the questions, using the data from the ratio table. Review students' answers, and discuss them as a group.

Pulling It All Together

Exit Ticket: Have students write a story problem that involves a proportional relationship. Suggest some possible ratios, e.g., 3 candy bars cost $1.00, or a 6 pack of soda costs $2.40.

Note: The following pages are intended for classroom use for students as a visual aid to learning.

Virginia Department of Education 2018

Name:

Ratio Tables

Mineral Water

Camps, Inc. gets mineral water shipped in cases. Trudy Camp, the owner of Camps, Inc., uses a table to keep track of the number of bottles and the number of cases. Each case holds 15 bottles. Find out how many bottles there are in 2, 3, 4, 5, 6, and 7 cases, and complete the ratio table below. What is the simplest way to find each number?

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Once the ratio table is complete, your teacher will explain the special relationship that exists among these numbers.

Cases	1	2	3	4	5	6	7
Bottles	15						

Movie Tickets

Mary Lou got a new job selling tickets at a movie theater. A ticket costs $5.50, but many people buy two or more tickets. Mary Lou decides to make a ratio table to help her figure out the total price instantly. Complete the ratio table below.

Tickets	1	2	3	4	5	6	7	8	9
Dollars	$5.50								

1. What is the ratio of 1 ticket to dollars?

2. Write the proportion for: 1 ticket is to $5.50 as 3 tickets are to $16.50. Use cross multiplication to check that your proportion is correct.

3. How much will 16 tickets cost? Use a proportion to determine the cost.