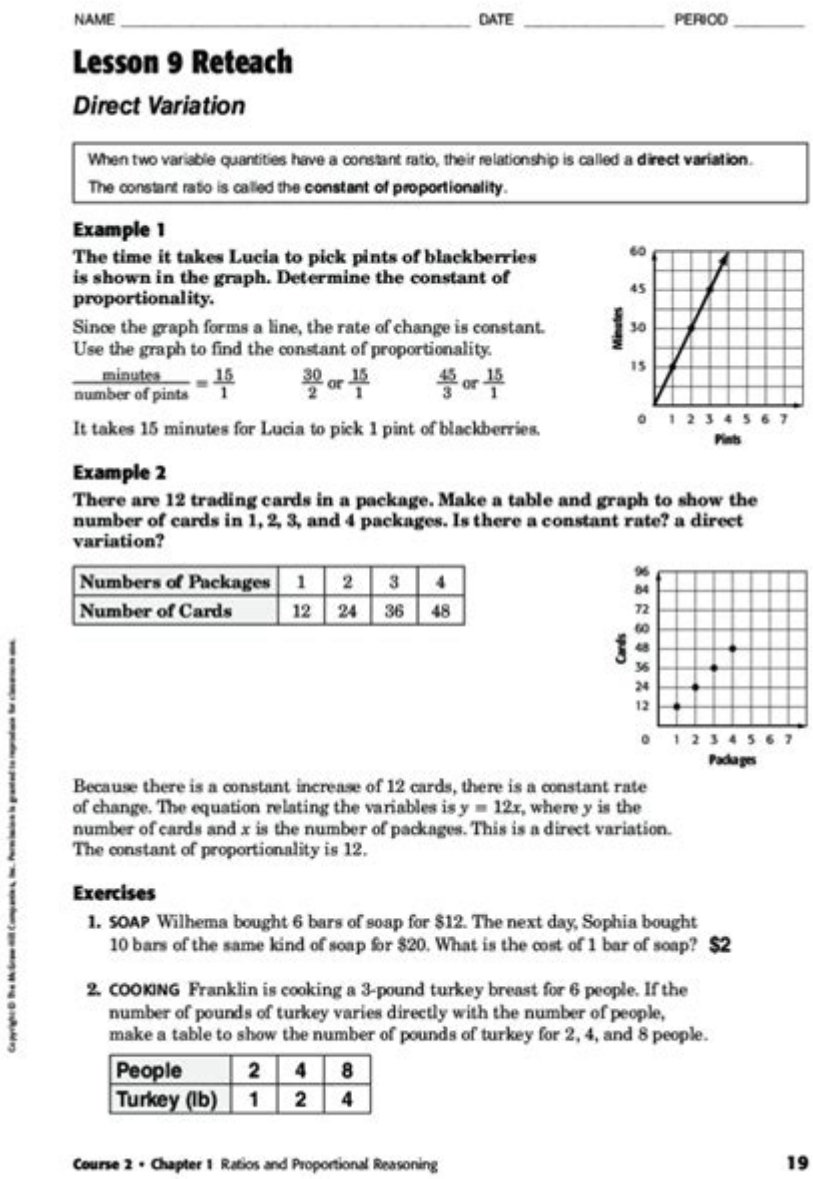
Lesson 6 Skills Practice Solve Proportional Relationships



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Lesson 9 Reteach

Direct Variation

When two variable quantities have a constant ratio, their relationship is called a **direct variation**. The constant ratio is called the **constant of proportionality**.

Example 1

The time it takes Lucia to pick pints of blackberries is shown in the graph. Determine the constant of proportionality.

Since the graph forms a line, the rate of change is constant. Use the graph to find the constant of proportionality.

$\frac{\text{minutes}}{\text{number of pints}} = \frac{15}{1}$ $\frac{30}{2}$ or $\frac{15}{1}$ $\frac{45}{3}$ or $\frac{15}{1}$

It takes 15 minutes for Lucia to pick 1 pint of blackberries.

Example 2

There are 12 trading cards in a package. Make a table and graph to show the number of cards in 1, 2, 3, and 4 packages. Is there a constant rate? a direct variation?

Numbers of Packages	1	2	3	4
Number of Cards	12	24	36	48

Because there is a constant increase of 12 cards, there is a constant rate of change. The equation relating the variables is $y = 12x$, where y is the number of cards and x is the number of packages. This is a direct variation. The constant of proportionality is 12.

Exercises

1. SOAP Wilhema bought 6 bars of soap for $12. The next day, Sophia bought 10 bars of the same kind of soap for $20. What is the cost of 1 bar of soap? **$2**

2. COOKING Franklin is cooking a 3-pound turkey breast for 6 people. If the number of pounds of turkey varies directly with the number of people, make a table to show the number of pounds of turkey for 2, 4, and 8 people.

People	2	4	8
Turkey (lb)	1	2	4

Lesson 6 Skills Practice Solve Proportional Relationships is an essential topic in mathematics that helps students understand how to identify and work with proportions in various contexts. Proportional relationships are foundational concepts that have applications in everyday life, science, economics, and more. This article delves into the skills necessary to solve proportional relationships, the methods of finding proportions, and practical examples that illustrate these concepts.

Understanding Proportional Relationships

Proportional relationships occur when two quantities maintain a constant ratio or fraction. This means that as one quantity increases or decreases, the other quantity changes in a way that preserves this ratio. The relationship can be expressed mathematically as:

$$ \frac{a}{b} = \frac{c}{d} $$

In this equation, a and c are two corresponding values of one quantity, while b and d represent the corresponding values of another quantity.

Identifying Proportional Relationships

Before solving proportional relationships, it is crucial to identify them. Here are steps and tips to help students determine whether a relationship is proportional:

1. Look for a Constant Ratio:
- Divide one quantity by the corresponding quantity in the pair. If the ratio remains the same for all pairs, the relationship is proportional.

2. Graphical Representation:
- Plot the pairs on a coordinate grid. If the points form a straight line that passes through the origin (0,0), the relationship is proportional.

3. Unit Rate Calculation:
- Calculate the unit rate for each pair. If the unit rate is the same across all pairs, the relationship is proportional.

4. Cross-Multiplication:
- When given two fractions, cross-multiply to check for equality. If $ a \cdot d = b \cdot c $, then the relationship is proportional.

Methods for Solving Proportional Relationships

Once a proportional relationship is identified, students can use various methods to solve problems involving these relationships. Here are some effective strategies:

1. Setting Up Proportions

Setting up a proportion is the first step in solving problems involving proportional relationships. This can be done by using the formula:

$$ \frac{a}{b} = \frac{c}{d} $$

To find an unknown value, rearrange the equation to isolate the variable. For instance, if you need to find x, the equation can be rewritten as:

$$ x = \frac{b \cdot c}{a} $$

2. Cross-Multiplication

Cross-multiplication is a powerful technique for solving proportions. It involves multiplying the numerator of one fraction by the denominator of the other fraction and vice versa. The steps are:

1. Write the proportion in the form $ \frac{a}{b} = \frac{c}{d} $.
2. Cross-multiply to get $ a \cdot d = b \cdot c $.
3. Solve for the unknown variable.

3. Using Unit Rates

Unit rates can simplify solving proportional relationships. To apply this method:

- Determine the unit rate of one of the quantities.
- Use the unit rate to find the unknown quantity by multiplying it by the desired amount.

For example, if a car travels 120 miles in 2 hours, the unit rate is:

$$ \text{Unit Rate} = \frac{120 \text{ miles}}{2 \text{ hours}} = 60 \text{ miles per hour} $$

If the question asks how far the car travels in 5 hours, you would calculate:

$$ 60 \text{ miles/hour} \times 5 \text{ hours} = 300 \text{ miles} $$

Practical Examples of Proportional Relationships

To solidify understanding, it is helpful to analyze real-world examples of proportional relationships. Here are a few scenarios students can explore:

Example 1: Recipe Adjustments

Suppose a recipe requires 2 cups of flour for 4 servings. If you want to know how much flour is needed for 10 servings, set up the proportion:

$$ \frac{2 \text{ cups}}{4 \text{ servings}} = \frac{x \text{ cups}}{10 \text{ servings}} $$

Cross-multiplying gives:

$$ 2 \cdot 10 = 4 \cdot x $$
$$ 20 = 4x $$
$$ x = 5 $$

Thus, 5 cups of flour are needed for 10 servings.

Example 2: Speed and Distance

If a runner completes 5 miles in 40 minutes, students can find out how long it would take to run 8 miles. Set up the proportion:

$$ \frac{5 \text{ miles}}{40 \text{ minutes}} = \frac{8 \text{ miles}}{x \text{ minutes}} $$

Cross-multiplying yields:

$$ 5x = 320 $$
$$ x = 64 $$

Therefore, it would take 64 minutes to run 8 miles.

Example 3: Scale Models

In creating a scale model of a building, the actual height of the building is 60 feet, while the model's height

is 5 feet. To find the scale factor, set up the proportion:

$$\frac{5 \text{ feet}}{60 \text{ feet}} = \frac{x \text{ feet}}{1 \text{ foot}}$$

Cross-multiplying gives:

$$5 \cdot 1 = 60 \cdot x$$
$$5 = 60x$$
$$x = \frac{1}{12}$$

This indicates the model is 1/12th the height of the actual building.

Applying Skills in Real-World Situations

Understanding and practicing how to solve proportional relationships is not only an academic exercise but also a skill that has practical implications. Here are some areas where these skills are particularly useful:

- Cooking and Baking: Adjusting recipes based on serving sizes.
- Finance: Calculating interest rates, taxes, and discounts.
- Shopping: Finding the best deals by comparing unit prices.
- Travel: Estimating travel times based on distance and speed.

Tips for Mastering Proportions

1. Practice Regularly: Regular practice helps reinforce concepts and improve problem-solving speed.
2. Use Visual Aids: Graphs and charts can aid in understanding proportional relationships visually.
3. Engage in Group Work: Discussing problems with peers can provide different perspectives and solutions.
4. Utilize Online Resources: There are numerous online platforms and videos that offer additional explanations and examples.

Conclusion

Lesson 6 Skills Practice Solve Proportional Relationships is vital for students as they develop their mathematical proficiency. By learning how to identify, set up, and solve proportional relationships, students not only enhance their math skills but also gain tools that are applicable in various aspects of life. Mastery of proportionality can lead to improved analytical thinking, problem-solving abilities, and real-world application, making it a crucial area of study in mathematics education. As students engage with these concepts, they prepare themselves for future challenges in math and beyond.

Frequently Asked Questions

What are proportional relationships?

Proportional relationships are relationships between two quantities where the ratio of one quantity to the other remains constant.

How can I identify if two quantities are proportional?

You can identify if two quantities are proportional by checking if their ratios are equivalent when compared. This can be done by cross-multiplying.

What is the formula for finding a constant of proportionality?

The constant of proportionality can be found using the formula k = y/x, where y is the dependent variable and x is the independent variable.

Can proportional relationships be represented on a graph?

Yes, proportional relationships can be represented on a graph as a straight line that passes through the origin (0,0).

What are some real-life examples of proportional relationships?

Real-life examples include speed (distance over time), recipes (ingredients proportion), and currency conversion (exchange rates).

How do you solve a problem involving proportional relationships?

To solve a problem involving proportional relationships, set up a proportion equation based on the given information and solve for the unknown variable.

What is the significance of unit rate in proportional relationships?

The unit rate in proportional relationships indicates how much of one quantity corresponds to one unit of another quantity, providing insight into the relationship's efficiency.

How can I use cross-multiplication to solve proportions?

To use cross-multiplication, multiply the numerator of one ratio by the denominator of the other ratio and set the two products equal to each other to find the unknown.

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