MSTAR INTERVENTION

L15

Lesson 15: Applying Proportionality to Percents

Lesson Objectives

- Students will set up and solve proportions in application problems involving percents, using percent bars.

Instructional Materials

Material	Quantity	Description
How Am I Doing? graph	1 per student	
Colored pencils	1 per student	
Display Masters	1 each	• Preview: Key Ideas: Applying Proportionality to Percents • Demonstrate: Jeans A–E • Demonstrate: Shirt A–D • Demonstrate: Bathing Suit A–D
Handouts	1 per student	• Cumulative Review • Practice 1 • Practice 2 • Independent Practice
Answer Keys	1 each	• Cumulative Review • Practice 1 • Practice 2 • Independent Practice

Cumulative Review

Have students answer the questions on the Cumulative Review handout. Go over the answers. Correct misconceptions. Have students use a colored pencil to make corrections as needed. Collect student papers to determine who needs additional instruction.

Preview

This lesson will build on students' conceptual knowledge of using proportions to find missing values in proportional relationships.

Display and introduce through a brief explanation the key ideas for this lesson:

- A percent is an amount out of 100. For example, if red beads make up 35% of the total beads, 35 beads out of every 100 are red.
- A ratio comparing 2 amounts can be set equivalent to a ratio with a denominator of 100 to determine a percentage. For example, the proportion

  $$\frac{3 \text{ cats}}{4 \text{ total animals}} = \frac{x \text{ cats}}{100 \text{ total animals}}$$

  can be used to find the percentage of cats, or the number of cats for every 100 total animals.

Use the Key Ideas: Applying Proportionality to Percents DM display master as needed.

Engage Prior/Informal Knowledge

To open the lesson, present problems to activate students' background knowledge and preskills, such as the following:

Set up and solve the proportion representing the following scenario:

On the swim team last year, there were 8 boys and 12 girls. Using this same rate, how many boys are on the team this year if there are 18 girls?

Demonstrate

1. Use a proportion to find a part of a whole.

Say: *In the previous lesson, we used proportions to find missing values in problem situations. Today, we will use proportions to find missing values in problems involving percents. We will solve 3 types of problems: finding a part of a whole, finding a percent, and finding the whole.* 1

Say: *A percent is a ratio of an amount out of 100. Because percents are ratios, we can write them in fraction form and use proportions to solve for a missing value.*

Say: *Consider this problem: The original price of a pair of jeans is $60. The pair of jeans is on sale for 50% off. If you bought the jeans, how much money would you save?*

Use the Jeans A DM display master as needed.

Say: *We can use a model called a percent bar to help us set up our proportion. The bar represents the total. The percent total is 100%. What is the total cost for the jeans at the original price? ($60) We know that the jeans are on sale for 50% off. So, we are looking for the part of $60 that is discounted from the price of the jeans.*

Use the Jeans B DM display master as needed. Throughout the example, point out how to use the percent bar.

Say: *In addition to the percent bar, we will use a graphic organizer to complete our example problems.*

Use the Jeans C DM display master as needed. Complete the graphic organizer with students.

1 **TEACHER NOTE**
This lesson assumes prior knowledge that a percent can be written as a decimal or a fraction. If students are not familiar with this concept, teach it before moving on to the examples in this lesson.

Say: *First, we will complete the Percent Bar Model column. We know that the whole bar represents 100% and we are looking for 50% off. We also know that the total, or the original price of the jeans, is $60.*

Say: *Now we need to determine the given information. Do we know the part of the total price of the jeans that is discounted? (no) So that is what we are looking for. We will put an unknown, x, to represent the unknown value. Do we know the whole, or the original price of the jeans? (yes, $60) Do we know the percent of the whole that we are looking for? (yes, 50%)*

Say: *Now we need to set up the proportion to find the missing value. We can use the percent bar model to help set up the proportion. For the examples we will explore today, the proportions can be modeled by* $\frac{part}{whole} = \frac{percent}{100}$.

Say: *We do not know the part, so we will use x to represent the unknown value. We know the whole is the original price of the jeans, which is $60. We know we are looking for 50% of the original price. Therefore, we can use the proportion* $\frac{x}{60} = \frac{50}{100}$ *to find the amount that is saved.*

TEACHER NOTE
Some students may recognize a constant scale factor between the numerators and denominators of each ratio in this and subsequent examples. Acknowledge the validity of this approach, but emphasize the strategy described in this lesson, as it is consistent with previous lessons.

Use the Jeans D **DM** display master as needed. Solve the proportion in the graphic organizer with students.

Say: *Because we have already determined an appropriate proportion to use to find the missing value, now we use a strategy for solving proportions to find x. Because there is not a friendly scale factor to multiply by, we will use cross products to solve.*

Say: *We will first multiply the denominator of the fraction representing the first ratio, 60, by the numerator of the fraction representing the second ratio, 50. 60 times 50 is equal to what number? (3,000)*

Say: *We will multiply the denominator of the fraction representing the second ratio, 100, by the numerator of the fraction representing the first ratio, x. 100 times x gives me what product? (100x) We set the products equal to each other: 3,000 = 100x.*

Say: *To find x, we divide both sides by 100. When I divide 3,000 by 100, what quotient do I get? (30) Therefore, x = $30. The amount saved as a result of the discount is $30.*

Use the Jeans E **DM** display master as needed.

Say: *Let's look at the problem 1 more time to see whether our answer makes sense. What is 50% as a fraction? ($\frac{1}{2}$) How much is half of $60? ($30) Does our answer make sense? (yes)*

2. Use a proportion to find a percent.

Say: *Consider this problem: The original price of a shirt is $20. The shirt is on sale for $5 off. What percent of the original price is the amount saved?*

Use the Shirt A **DM** display master as needed.

Say: *For this problem, we will use the same graphic organizer as the last problem.*

Use the Shirt B **DM** display master as needed. Complete the graphic organizer with students.

Say: *First, we will complete the Percent Bar Model column of the graphic organizer. We know that the whole bar represents 100%, but we are not sure of the percent that has been discounted. We also know that the total price, or original price, of the shirt is $20 and $5 is discounted.*

Say: *Now we need to determine the given information. Do we know the part of the total price of the shirt that is discounted? (yes, $5) Do we know the whole, or the original price of the shirt? (yes, $20) Do we know the percent of the whole that was discounted? (no) So that is what we are looking for. We will use x to represent the unknown value.*

Say: *Now we need to set up the proportion to find the missing value. We can use the percent bar model to help set up the proportion. The proportion can be modeled by* $\frac{part}{whole} = \frac{percent}{100}$. *We know the part of the original price that is discounted, $5. We know the whole is the original price of the shirt, $20. We do not know the percent that $5 represents of the original price, so we use x to represent the unknown value. Therefore, we can use the proportion* $\frac{5}{20} = \frac{x}{100}$ *to find the percent that is discounted from the original price.*

Use the Shirt C **DM** display master as needed. Solve the proportion in the graphic organizer with students.

Say: *Because we have already determined an appropriate proportion to use to find the missing value, now we use a previously learned strategy to solve the proportion. First, we look at the denominators of the fractions that represent the ratios to determine whether there is a friendly scale factor that 20 can be multiplied by to get 100. Is there a scale factor that 20 can be multiplied by to get 100? (yes, 5)*

Say: *I multiply the numerator of the fraction representing the first ratio, 5, by the same scale factor to get the unknown numerator of the fraction representing the second ratio. If I multiply 5 by 5, what product do I get? (25) Therefore, x = 25%. The amount saved is 25% of the original price.*

Use the Shirt D **DM** display master as needed.

3. Use a proportion to find a whole.

Say: *Consider this problem: A bathing suit is on sale for 40% off. With the sale, you will save $18. What is the original price of the bathing suit?*

Use the Bathing Suit A **DM** display master as needed.

Say: *We will use the same graphic organizer again for this problem.*

Use the Bathing Suit B **DM** display master as needed. Complete the graphic organizer with students.

Say: *First, we will complete the Percent Bar Model column of the graphic organizer. We know that the whole bar represents 100%, and we know that the discount is 40%. We also know that with the sale, the savings is $18, but we do not know the original price of the bathing suit.*

Say: *Now we need to determine the given information. Do we know the part of the total price of the bathing suit that is discounted? (yes, $18) Do we know the whole, or the original price of the bathing suit? (no) So that is what we are looking for. We use x to represent the unknown value. Do we know the percent of the whole that is discounted off the original price? (yes, 40%)*

Say: *Now we need to set up the proportion to find the missing value. We can use the percent bar model to help set up the proportion. The proportion can be modeled by* $\frac{part}{whole} = \frac{percent}{100}$. *We know the part of the original price that will be discounted, $18. We do not know the whole, or the original price, so we use x to represent the unknown value. We know the percent that is discounted from the original price, 40%. Therefore, we can use the proportion* $\frac{18}{x} = \frac{40}{100}$ *to find the original price of the bathing suit.* 3

Use the Bathing Suit C **DM** display master as needed. Solve the proportion in the graphic organizer with students.

3 **TEACHER NOTE**

Allow students to use a calculator for more difficult calculations. It is more important that students understand the process of finding the missing value than be able to do the calculations without using a calculator.

Say: *Because we have already determined an appropriate proportion to use to find the missing value, now we use our prior knowledge of solving proportions. Because there is not a friendly scale factor to multiply by, we use cross products to solve.*

Say: *We first multiply the denominator of the fraction representing the first ratio, x, by the numerator of the fraction representing the second ratio, 40. x times 40 gives me what product? (40x)*

Say: *Next, we multiply the denominator of the fraction representing the second ratio, 100, by the numerator of the fraction representing the first ratio, 18. 100 times 18 gives me what product? (1,800) We set the products equal to each other, 40x = 1,800. To find x, we divide both sides by 40. When I divide 1,800 by 40, what quotient do I get? (45) Therefore, x = $45. The original price of the bathing suit is $45.*

Use the Bathing Suit D 

display master as needed.

Practice

For each practice activity, provide detailed feedback to students, highlighting what was done correctly and what needs improvement. Provide opportunities for students to correct their errors. Collect student work to review and monitor student progress.

Activity 1: Help students complete the activity on the Practice 1 handout.

Activity 2: Have students work in pairs to complete the activity on the Practice 2 handout.

Independent Practice

1. Have students work independently to complete the activity on the Independent Practice handout.

2. Go over the answers (students self-check and correct, using a colored pencil).

3. Have students record the number correct in the box and complete their How Am I Doing? graph.

4. Collect the papers to review and monitor student progress.

Closure

Review the key ideas. Have students provide examples from the lesson.

Have students discuss their answer to the following questions:

- How is a percent represented as a ratio? For example, how would you write 64% as a ratio?
- When would you use a percent as a ratio? What about as a decimal?

Clear up any misconceptions. Students who are not confident with the process of solving proportions involving percents need additional instruction.