Unit 3, Lesson 5

Reasoning about Equations and Tape Diagrams (Part 2)

Let's use tape diagrams to help answer questions about situations where the equation has parentheses.

5.1 Math Talk: Seeing Structure

Solve each equation mentally.

- $x + 1 = 5$
- $2(x + 1) = 10$
- $3(x + 1) = 15$
- $500 = 100(x + 1)$

5.2 More Situations and Diagrams

Draw a tape diagram to represent each situation. For some of the situations, you need to decide what to represent with a variable.

1. Each of 5 gift bags contains x pencils. Tyler adds 3 more pencils to each bag. Altogether, the gift bags contain 20 pencils.

2. Noah drew an equilateral triangle with sides of length 5 inches. He wants to increase the length of each side by x inches so the triangle is still equilateral and has a perimeter of 20 inches.

3. An art class charges each student $3 to attend plus a fee for supplies. Today, $20 was collected for the 5 students attending the class.

4. Elena ran 20 miles this week, which was three times as far as Clare ran this week. Clare ran 5 more miles this week than she did last week.

5.3 More Situations, Diagrams, and Equations

Each situation in the previous activity is represented by one of the equations.

$(x + 3) \cdot 5 = 20$ $\qquad$ $3(x + 5) = 20$

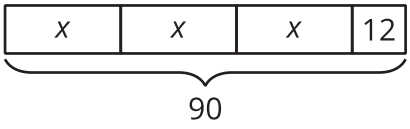
1. Match each situation to an equation.
2. Find the solution to each equation. Use your diagrams to help you reason.
3. What does each solution tell you about its situation?

Are you ready for more?

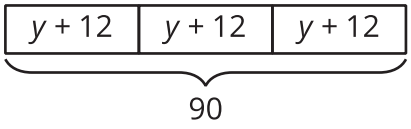
Han, his sister, his dad, and his grandmother step onto a crowded bus with only 3 open seats for a 42-minute ride. They decide Han's grandmother should sit for the entire ride. Han, his sister, and his dad take turns sitting in the remaining two seats, and Han's dad sits 1.5 times as long as Han and his sister each sit. How many minutes did each family member spend sitting?

5.4 Even More Situations, Diagrams, and Equations

A



B



Story 1: Lin had 90 flyers to hang up around the school. She gave 12 flyers to each of three volunteers. Then she took the remaining flyers and divided them up equally between the three volunteers.

Story 2: Lin had 90 flyers to hang up around the school. After giving the same number of flyers to each of three volunteers, she had 12 left to hang up by herself.

1. Which diagram goes with which story? Be prepared to explain your reasoning.

2. In each diagram, what part of the story does the variable represent?

3. Write an equation corresponding to each story. If you get stuck, use the diagram.

4. Find the value of the variable in the story.

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Lesson 5 Summary

Equations with parentheses can represent a variety of situations.

1. Lin volunteers at a hospital and is helping prepare 10 toy baskets for children who are patients. After Lin adds 2 items to each basket, the supervisor says 140 items have been equally placed in the baskets. Lin wants to know how many toys were in each basket before she added items.
2. A large store has the same number of workers on each of 2 teams to handle different shifts. The managers decide to add 10 workers to each team, bringing the total number of workers to 140. An executive at the company that runs this chain of stores wants to know how many employees were in each team before the increase.

Each basket in the first story has an unknown number of toys, x, that is increased by 2. Then 10 groups of $x + 2$ give a total of 140 toys. An equation representing this situation is $10(x + 2) = 140$. Since 10 times an amount is 140, that amount is 14, which is the total number of items in each basket. Before Lin added the 2 items there were $14 - 2$ or 12 toys in each basket.

The executive in the second story knows that the size of each team of y employees has been increased by 10. There are now 2 teams of $y + 10$ each. An equation representing this situation is $2(y + 10) = 140$. Since 2 times an amount is 140, that amount is 70, which is the new size of each team. The value of y is $70 - 10$ or 60. There were 60 employees on each team before the increase.