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Lesson 4: Reasoning about Equations and Tape Diagrams (Part 1)

Let's see how tape diagrams can help us answer questions about unknown amounts in stories.

4.1: Algebra Talk: Seeing Structure

Find a solution to each equation without writing anything down.

- $x + 1 = 5$ 4
- $2(x + 1) = 10$ 4
- $3(x + 1) = 15$ 4
- $500 = 100(x + 1)$ 4

$$\begin{array}{r} x + 1 = 5 \\ -1 \quad -1 \\ \hline x = 4 \end{array}$$

$$\begin{array}{r} 2(x + 1) = 10 \\ -2 \quad -2 \\ \hline 2x + 2 = 10 \\ -2 \quad -2 \\ \hline 2x = 8 \\ \frac{2x}{2} = \frac{8}{2} \\ x = 4 \end{array}$$

$$\begin{array}{r} 2x + 2 = 10 \\ -2 \quad -2 \\ \hline 2x = 8 \\ \frac{2x}{2} = \frac{8}{2} \\ x = 4 \end{array}$$

$$\begin{array}{r} 2x = 8 \\ \frac{2x}{2} = \frac{8}{2} \\ x = 4 \end{array}$$

$$\begin{array}{r} 3(x + 1) = 15 \\ -3 \quad -3 \\ \hline 3x + 3 = 15 \\ -3 \quad -3 \\ \hline 3x = 12 \\ \frac{3x}{3} = \frac{12}{3} \\ x = 4 \end{array}$$

$$\begin{array}{r} 3x + 3 = 15 \\ -3 \quad -3 \\ \hline 3x = 12 \\ \frac{3x}{3} = \frac{12}{3} \\ x = 4 \end{array}$$

$$\begin{array}{r} 3x = 12 \\ \frac{3x}{3} = \frac{12}{3} \\ x = 4 \end{array}$$

$$x = 4$$

4.2: Situations and Diagrams

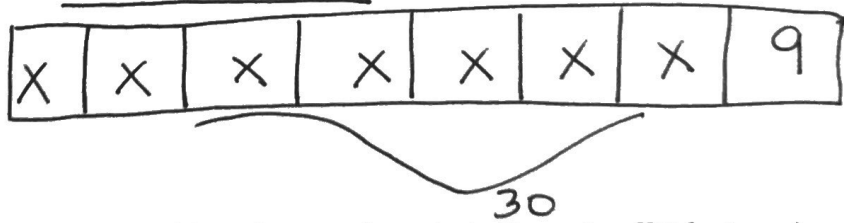
Draw a tape diagram to represent each situation. For some of the situations, you need to decide what to represent with a variable.



- Diego has 7 packs of markers. Each pack has x markers in it. After Lin gives him 9 more markers, he has a total of 30 markers.

$$\begin{array}{r} 7x + 9 = 30 \\ -9 \quad -9 \\ \hline 7x = 21 \\ \frac{7x}{7} = \frac{21}{7} \\ x = 3 \end{array}$$

$$\frac{7x}{7} = \frac{21}{7} \Rightarrow x = 3$$

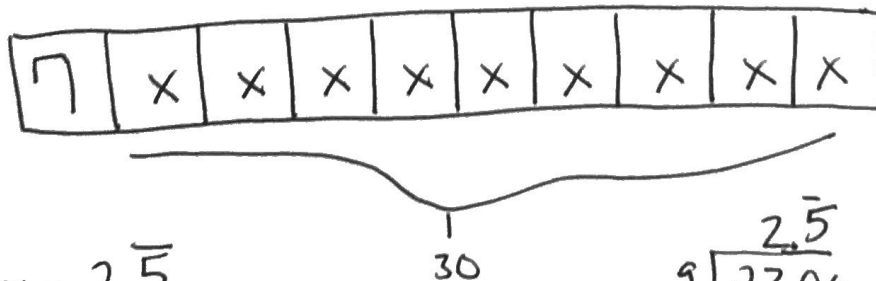


- Elena is cutting a 30-foot piece of ribbon for a craft project. She cuts off 7 feet, and then cuts the remaining piece into 9 equal lengths of x feet each.

$$\begin{array}{r} 9x + 7 = 30 \\ -7 \quad -7 \\ \hline 9x = 23 \\ \frac{9x}{9} = \frac{23}{9} \\ x = 2.\bar{5} \end{array}$$

$$\frac{9x}{9} = \frac{23}{9}$$

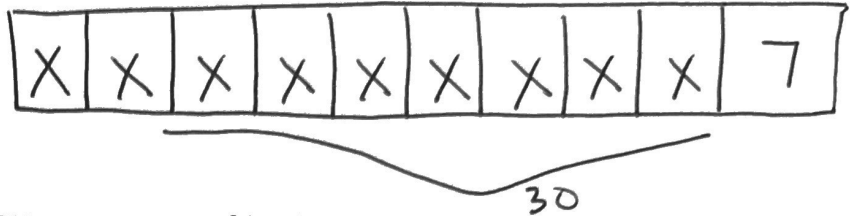
$$x = 2.\bar{5}$$



$$\begin{array}{r} 25 \\ 9 \overline{) 23.00} \\ \underline{-18} \\ 50 \\ \underline{-45} \\ 50 \\ \underline{-45} \\ 50 \end{array}$$

3. A construction manager weighs a bundle of 9 identical bricks and a 7-pound concrete block. The bundle weighs 30 pounds.

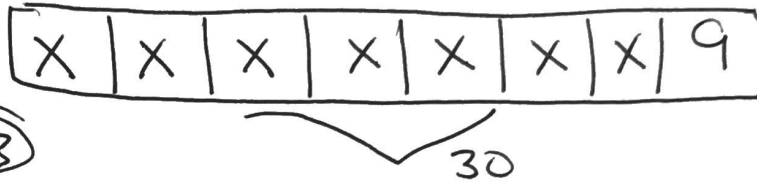
$$9x + 7 = 30$$



4. A skating rink charges a group rate of \$9 plus a fee to rent each pair of skates. A family rents 7 pairs of skates and pays a total of \$30.

$$7x + 9 = 30$$

$$\begin{array}{r} 7x + 9 = 30 \\ -9 \quad -9 \\ \hline 7x = 21 \\ \hline x = 3 \end{array}$$



~~X~~ Andre bakes 9 pans of brownies. He donates 7 pans to the school bake sale and keeps the rest to divide equally among his class of 30 students.

4.3: Situations, Diagrams, and Equations

1. $7x + 9 = 30$
2. $30 = 9x + 7$
3. $30x + 7 = 9$

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

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?