## Lesson 7: Reasoning about Solving Equations (Part 1)

Let’s see how a balanced hanger is like an equation and how moving its weights is like solving the equation.

### 7.1: Hanger Diagrams

In the two diagrams, all the triangles weigh the same and all the squares weigh the same.

For each diagram, come up with . . .

1. One thing that *must* be true
2. One thing that *could* be true
3. One thing that *cannot possibly* be true



### 7.2: Hanger and Equation Matching

On each balanced hanger, figures with the same letter have the same weight.

1. Match each hanger to an equation. Complete the equation by writing $x$, $y$, $z$, or $w$ in the empty box.

	* $2+3=5$
	* $3+2=3$
	* $6=2+3$
	* $7=3+1$
2. Find the solution to each equation. Use the hanger to explain what the solution means.



### 7.3: Use Hangers to Understand Equation Solving

Here are some balanced hangers where each piece is labeled with its weight. For each diagram:

1. Write an equation.
2. Explain how to figure out the weight of a piece labeled with a letter by reasoning about the diagram.
3. Explain how to figure out the weight of a piece labeled with a letter by reasoning about the equation.



### Lesson 7 Summary

In this lesson, we worked with two ways to show that two amounts are equal: a balanced hanger and an equation. We can use a balanced hanger to think about steps to finding an unknown amount in an associated equation.

The hanger shows a total weight of 7 units on one side that is balanced with 3 equal, unknown weights and a 1-unit weight on the other. An equation that represents the relationship is $7=3x+1$.



We can remove a weight of 1 unit from each side and the hanger will stay balanced. This is the same as subtracting 1 from each side of the equation.



An equation for the new balanced hanger is $6=3x$.



So the hanger will balance with $\frac{1}{3}$ of the weight on each side: $\frac{1}{3}⋅6=\frac{1}{3}⋅3x$.



The two sides of the hanger balance with these weights: 6 1-unit weights on one side and 3 weights of unknown size on the other side.



Here is a concise way to write the steps above:

$\begin{matrix}7&=3x+1&\\6&=3x&after subtracting 1 from each side\\2&=x&after multiplying each side by \frac{1}{3}\end{matrix}$



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