

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. 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.

7 = 3x + 17 - 1 = 3x + 1 - 16 = 3x

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: $\frac{1}{3} \cdot 6 = \frac{1}{3} \cdot 3x$.

6 = 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:

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