

Lesson 7: Reasoning about Solving Equations (Part 1)

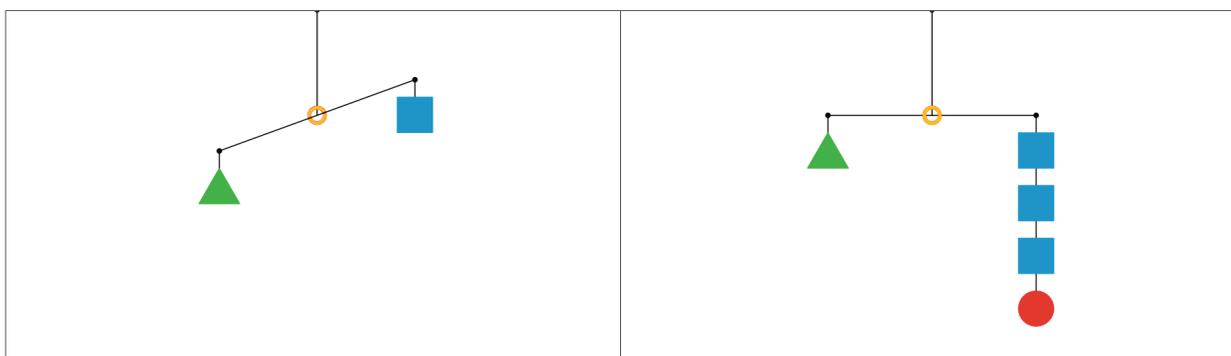
Let's see how a balanced hanger is like an equation and how moving its weights is like solving the equation.

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.

○ $2\boxed{} + 3 = 5$

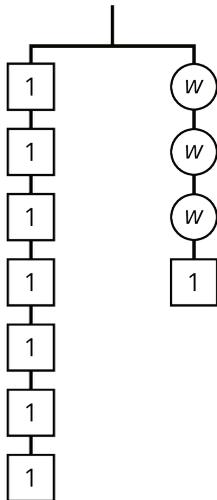
○ $3\boxed{} + 2 = 3$

○ $6 = 2\boxed{} + 3$

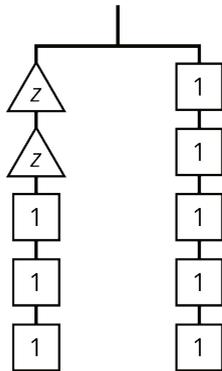
○ $7 = 3\boxed{} + 1$

2. Find the solution to each equation. Use the hanger to explain what the solution means.

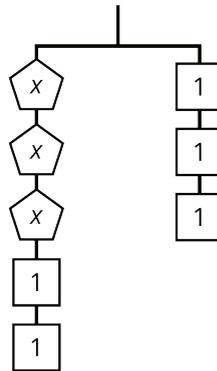
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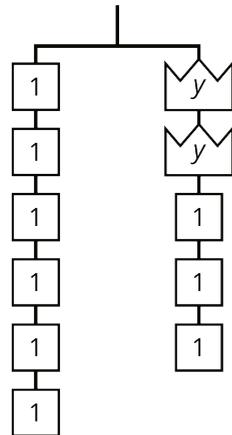
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C



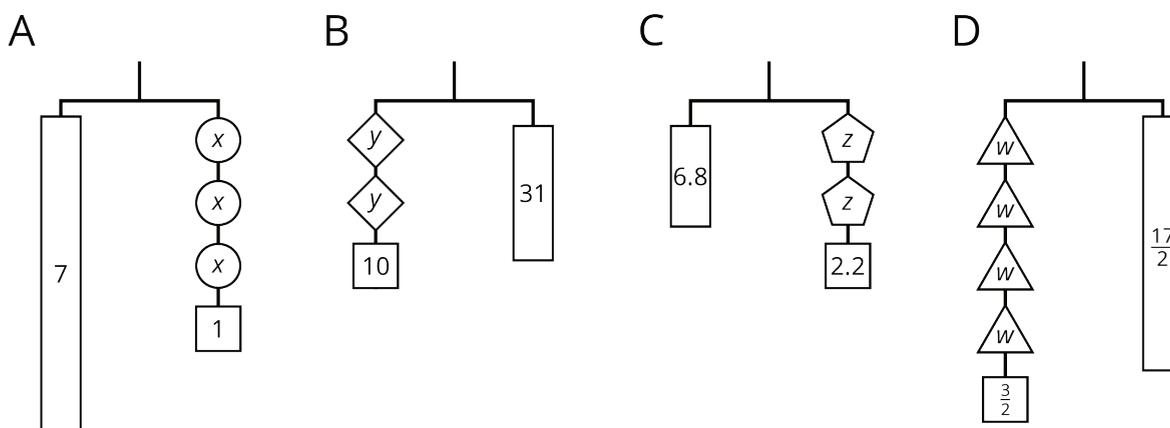
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7.3: Use Hangers to Understand Equation Solving

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

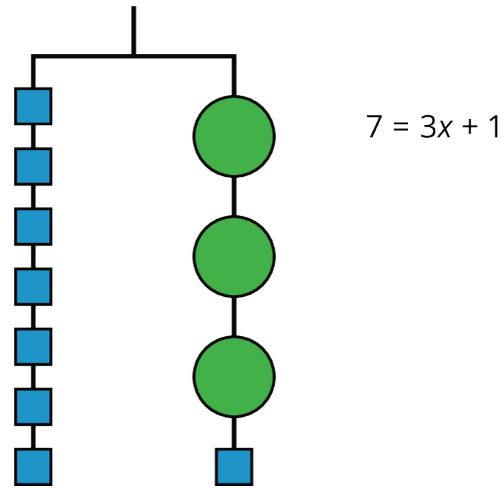
1. Write an equation.
2. Explain how to figure out the weight of a piece labeled with a letter by reasoning about the diagram.
3. Explain how to figure out the weight of a piece labeled with a letter by reasoning about the equation.



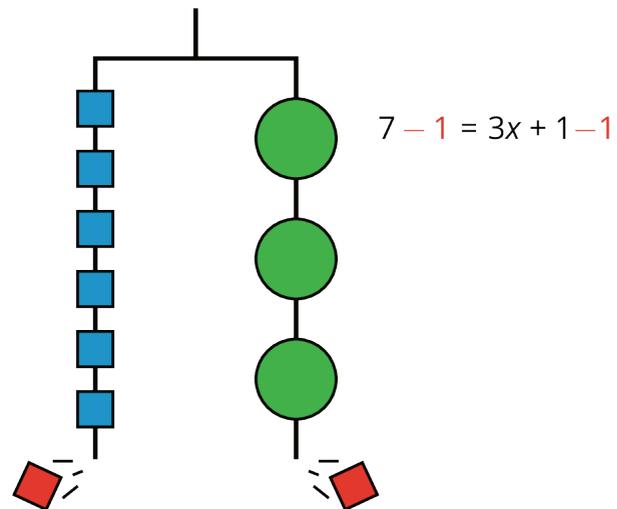
Lesson 7 Summary

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.

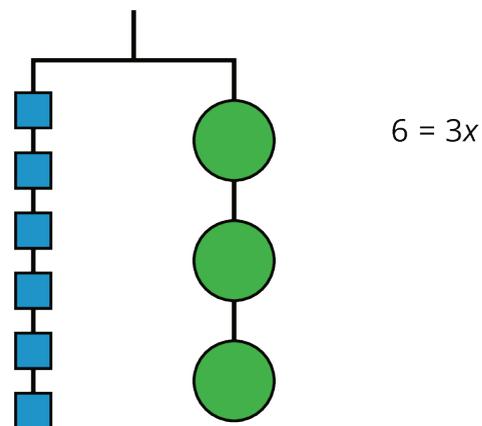
The hanger shows a total weight of 7 units on one side that is balanced with 3 equal, unknown weights and a 1-unit weight on the other. An equation that represents the relationship is $7 = 3x + 1$.



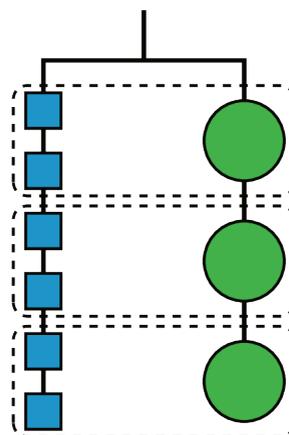
We can remove a weight of 1 unit from each side and the hanger will stay balanced. This is the same as subtracting 1 from each side of the equation.



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

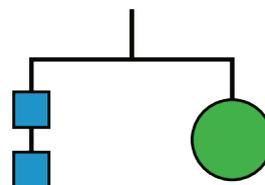


So the hanger will balance with $\frac{1}{3}$ of the weight on each side: $\frac{1}{3} \cdot 6 = \frac{1}{3} \cdot 3x$.



$$6 = 3x$$

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.



$$2 = x$$

Here is a concise way to write the steps above:

$$7 = 3x + 1$$

$$6 = 3x \quad \text{after subtracting 1 from each side}$$

$$2 = x \quad \text{after multiplying each side by } \frac{1}{3}$$