



# Reasoning about Solving Equations (Part 1)

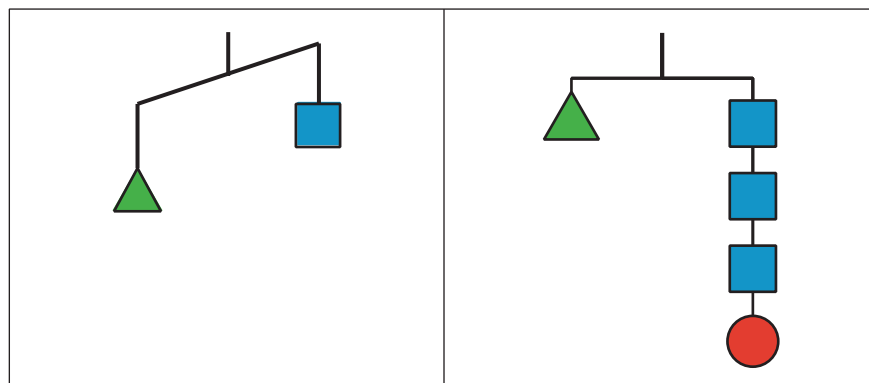
Let's see how a balanced hanger is like an equation and how moving its weights is like solving the equation.

## 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, shapes with the same variable have the same weight.

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

◦  $2\square + 3 = 5$

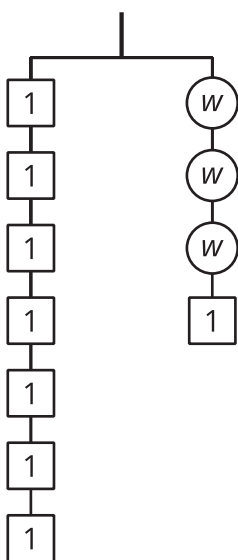
◦  $3\square + 2 = 3$

◦  $6 = 2\square + 3$

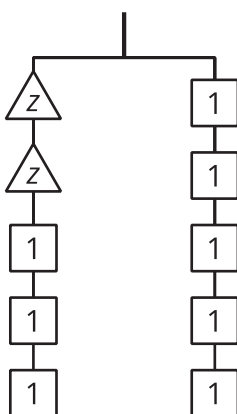
◦  $7 = 3\square + 1$

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

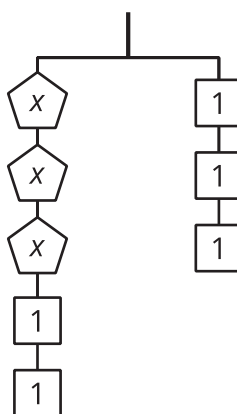
**A**



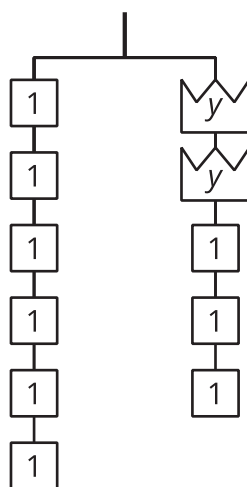
**B**



**C**



**D**

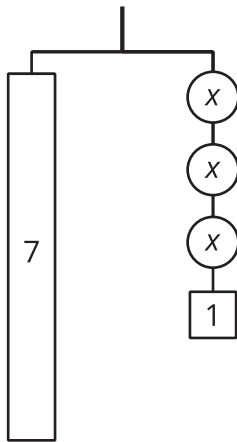
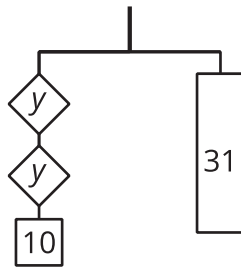
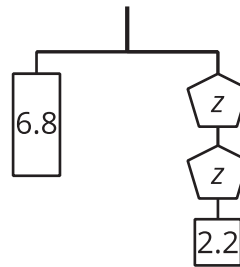
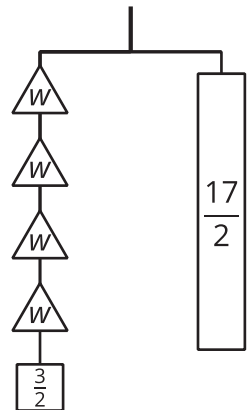


## 7.3

## Use Hangers to Understand Equation Solving

Here are some balanced hangers diagrams where each piece is labeled with its weight in the same units. For each diagram:

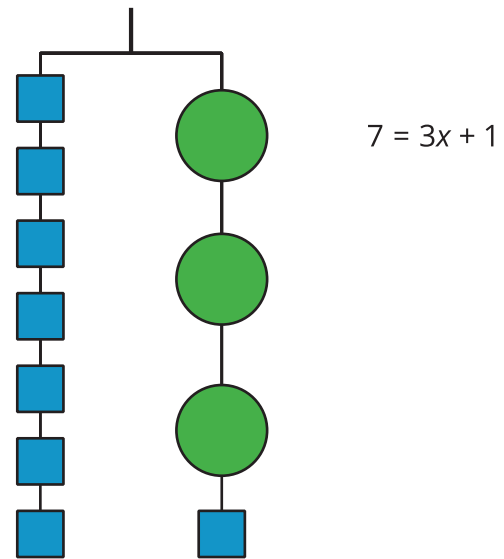
1. Write an equation.
2. Explain how to figure out the weight of a piece labeled with a variable by reasoning about the diagram.
3. Explain how to figure out the weight of a piece labeled with a variable by reasoning about the equation.

**A****B****C****D**

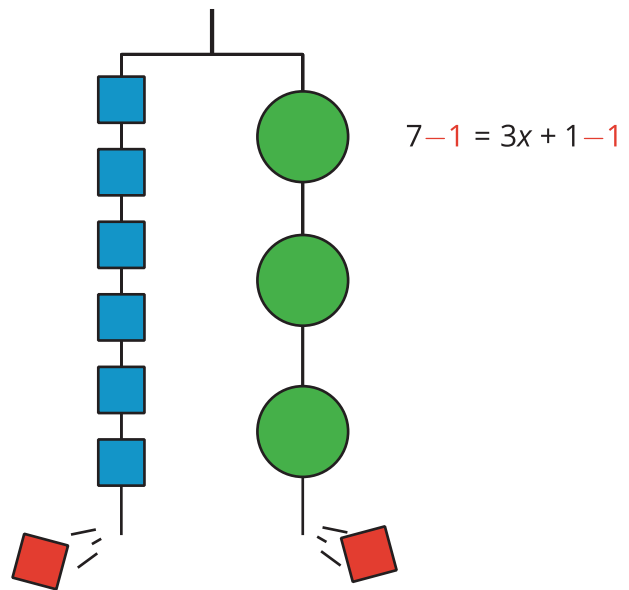
## Lesson 7 Summary

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

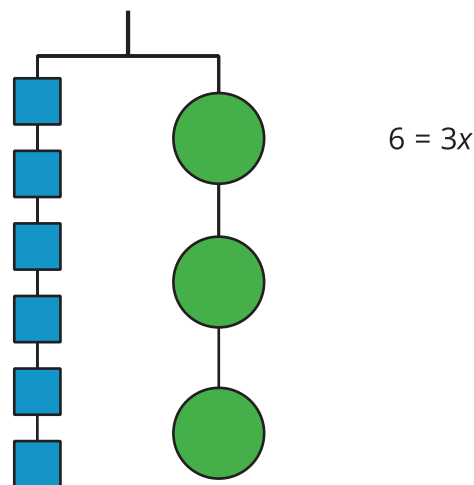
This hanger diagram shows a total weight of 7 units on one side that is balanced with 3 equal, unknown weights and a 1-unit weight on the other. An equation that represents the relationship is  $7 = 3x + 1$ .



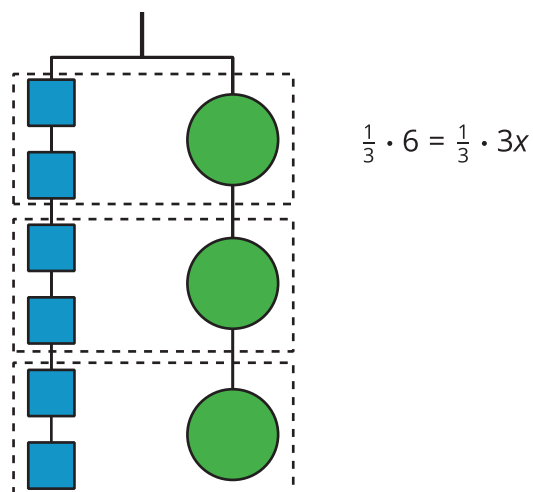
We can remove a weight of 1 unit from each side and the hanger will stay balanced. This is the same as subtracting 1 from each side of the equation.



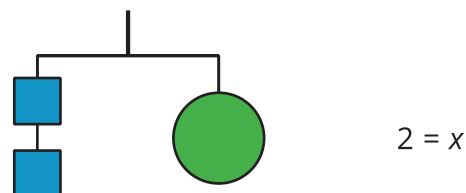
An equation for the new balanced hanger is  
 $6 = 3x$ .



We can make 3 equal groups on each side and the hanger will stay balanced. This is the same as dividing each side of the equation by 3 (or multiplying each side by  $\frac{1}{3}$ ). In other words, the hanger will balance with  $\frac{1}{3}$  of the weight on each side.



The two sides of the hanger balance with two 1-unit weights on one side and 1 weight of unknown size on the other side. So, the unknown weight is 2 units.



Here is a concise way to write the steps above:

$$7 = 3x + 1$$

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

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