# Reasoning about Solving Equations (Part 1)
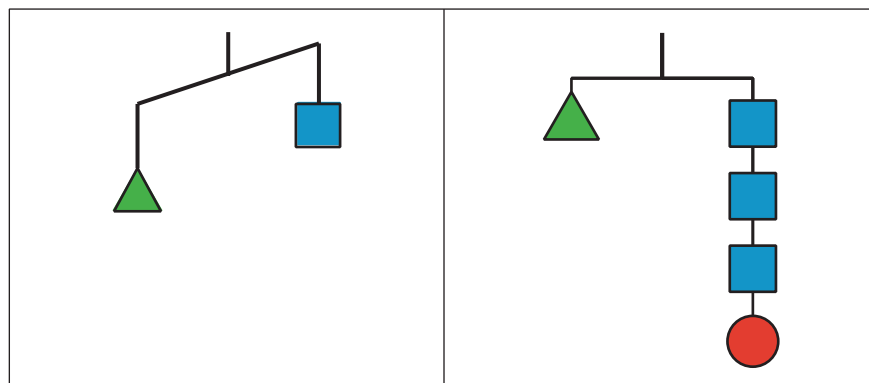
Let's see how a balanced hanger is like an equation and how moving its weights is like solving the equation.

## 6.1    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

On each balanced hanger, shapes with the same variable 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.
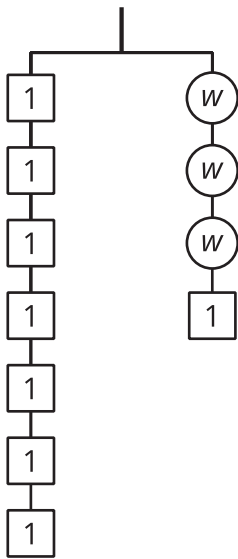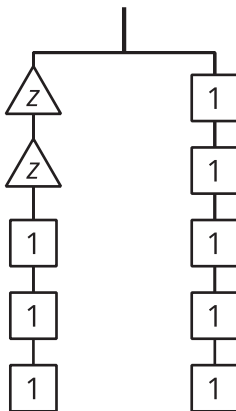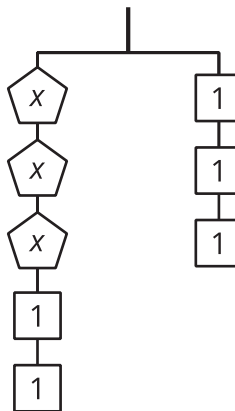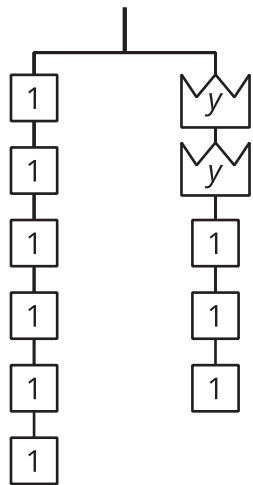
   ◦ $2\boxed{\phantom{x}} + 3 = 5$

   ◦ $3\boxed{\phantom{x}} + 2 = 3$

   ◦ $6 = 2\boxed{\phantom{x}} + 3$

   ◦ $7 = 3\boxed{\phantom{x}} + 1$

2. Find the solution to each equation. Use the hanger to explain what the solution means.
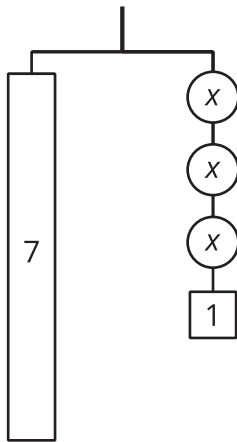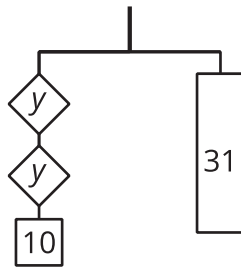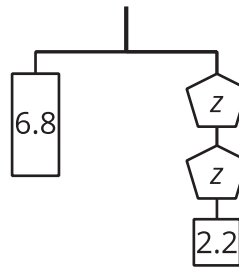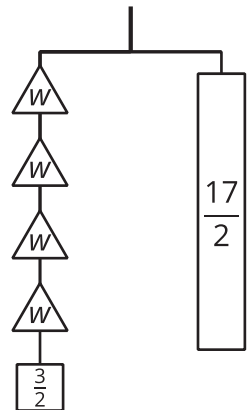
   **A**  **B**  **C**  **D**

## 6.3  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:
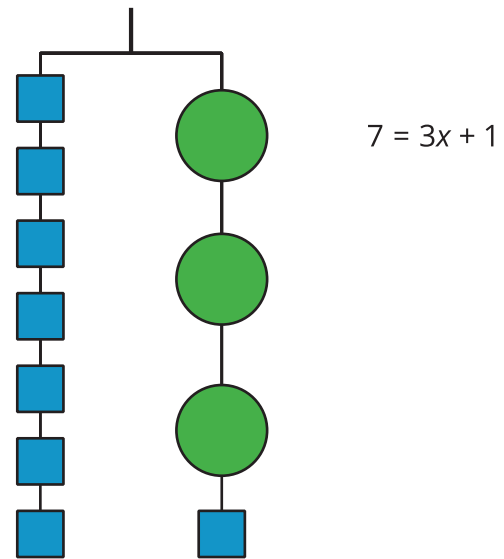
1.  Write an equation.

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**

7

x
x
x
1

**B**

y
y
10

31

**C**

6.8

z
z
2.2

**D**

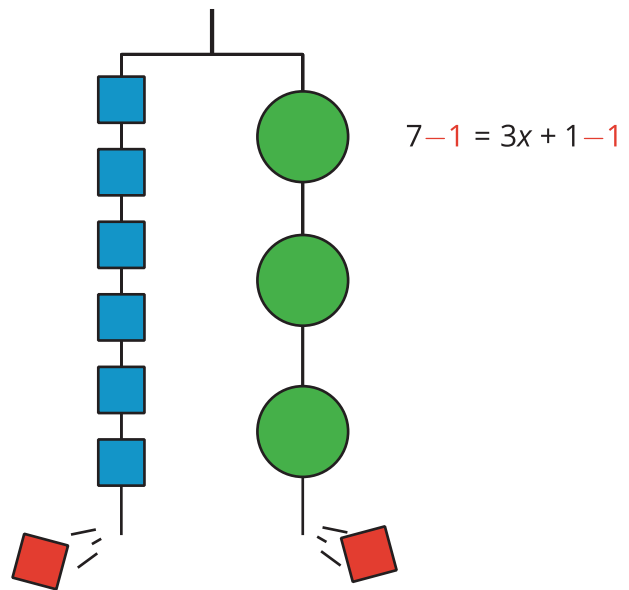w
w
w
w
$\frac{3}{2}$

$\frac{17}{2}$

## 👥 Lesson 6 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.
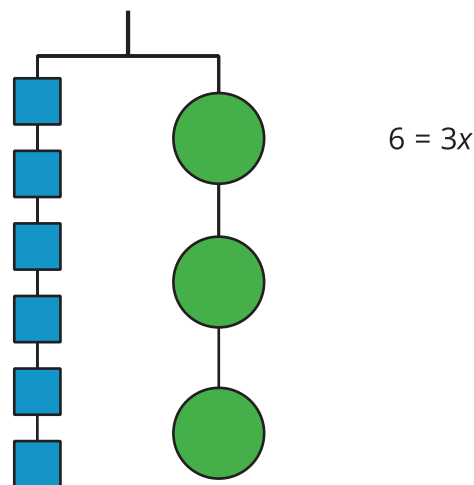
This hanger diagram shows a total weight of 7 units on one side that is balanced with 3 equal, unknown weights and a 1-unit weight on the other. An equation that represents the relationship is $7 = 3x + 1$.
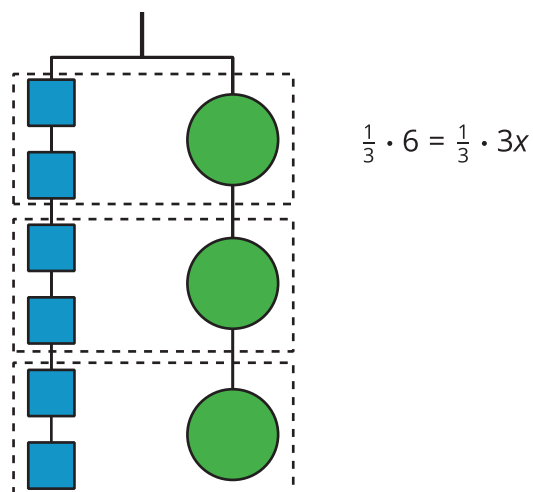
$$7 = 3x + 1$$

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.
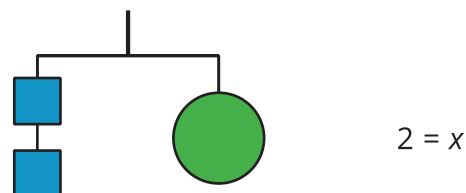
$$7 - 1 = 3x + 1 - 1$$

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

$6 = 3x$

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.

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

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.

$2 = x$

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 $\frac{1}{3}$