



# Reasoning about Solving Equations (Part 2)

Let's use hangers to understand two different ways of solving equations with parentheses.

## 7.1 Equivalent to $2(x + 3)$

Select **all** the expressions equivalent to  $2(x + 3)$ .

- A.  $2 \cdot (x + 3)$
- B.  $(x + 3)^2$
- C.  $2 \cdot x + 2 \cdot 3$
- D.  $2 \cdot x + 3$
- E.  $(2 \cdot x) + 3$
- F.  $(2 + x)^3$



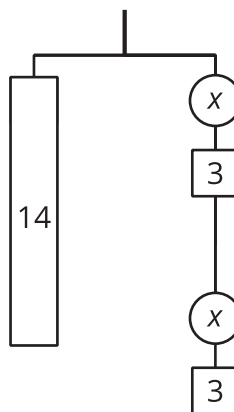
## 7.2

## Either Or

1. Explain why either of these equations could represent this hanger:

$$14 = 2(x + 3) \text{ or}$$

$$14 = 2x + 6$$

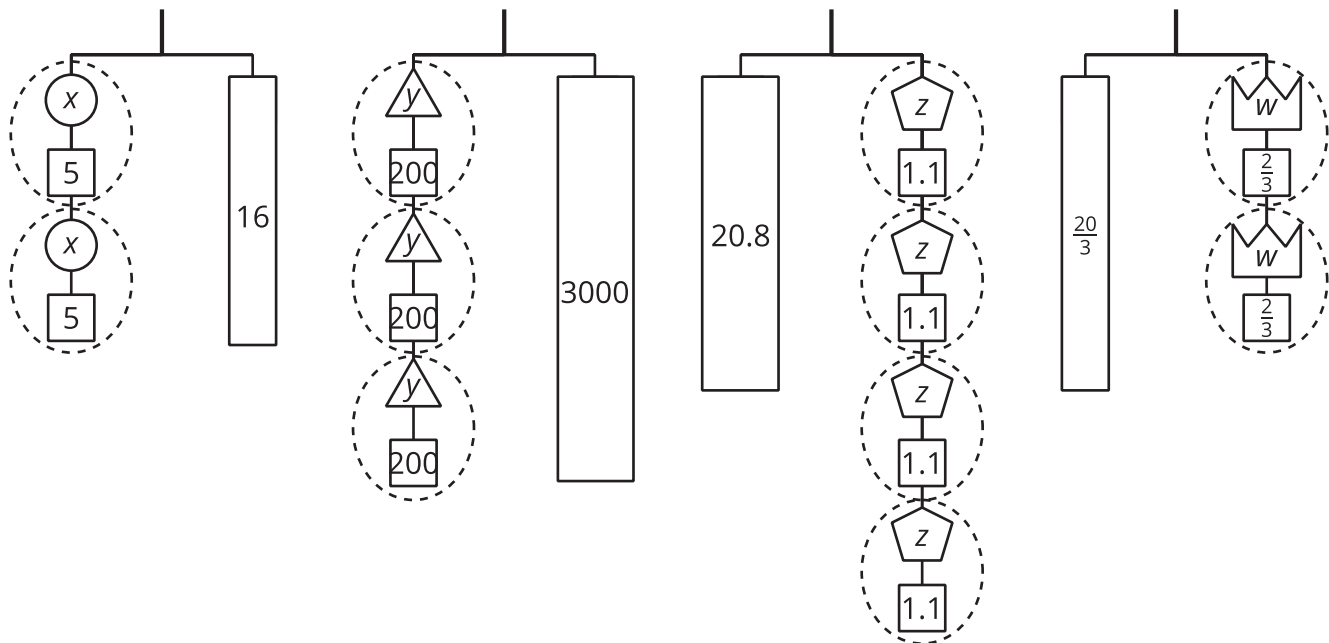


2. Find the weight of one circle. Be prepared to explain your reasoning.

## 7.3

# Use Hangers to Understand Equation Solving, Again

Here are some balanced hanger diagrams. Each piece is labeled with its weight.



For each diagram:

1. Explain how to figure out the weight of a piece labeled with a variable by reasoning about the diagram.
2. Identify which of the following equations matches the diagram. Then explain how to figure out the weight of a piece labeled with a variable by reasoning about the equation.

$$2(x + 5) = 16$$

$$3(y + 200) = 3,000$$

$$20.8 = 4(z + 1.1)$$

$$\frac{20}{3} = 2\left(w + \frac{2}{3}\right)$$

## Lesson 7 Summary

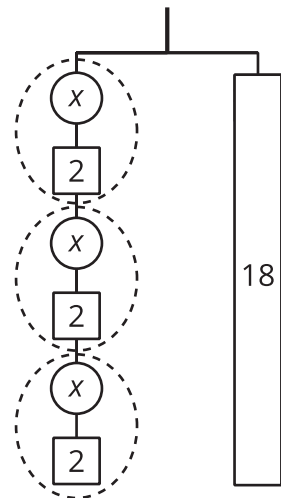
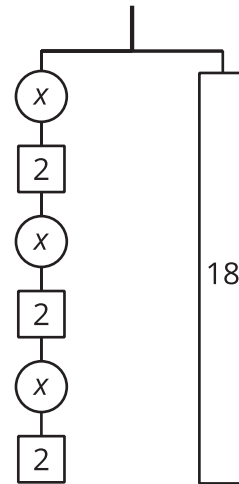
The balanced hanger diagram shows the amounts on the left equal the amounts on the right. The left side has 3 pieces that each have unknown weight  $x$  and 3 pieces that each weigh 2 units. So, the left side shows 3  $x$ 's plus 6 units. The right side shows 18 units. We could represent this diagram with an equation and solve the equation the same way we did before.

$$3x + 6 = 18$$

$$3x = 12$$

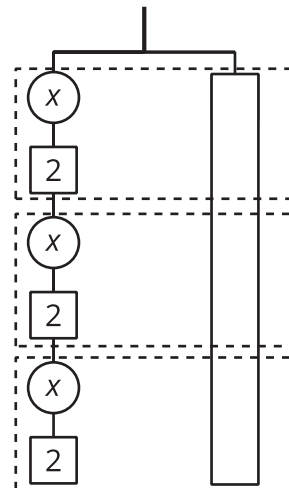
$$x = 4$$

Since there are 3 groups of  $x + 2$  on the left, we could represent this hanger with a different equation:  $3(x + 2) = 18$ .



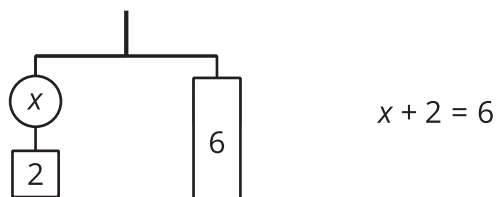
$$3(x + 2) = 18$$

The two sides of the hanger balance with these weights: 3 groups of  $x + 2$  on one side, and 18, or 3 groups of 6, on the other side.

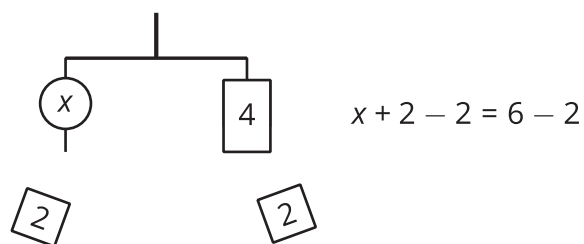


$$\frac{1}{3} \cdot 3(x + 2) = \frac{1}{3} \cdot 18$$

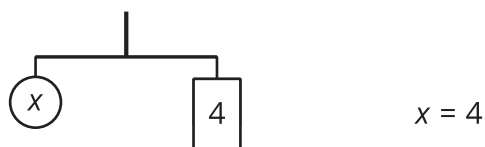
The two sides of the hanger will balance with  $\frac{1}{3}$  of the weight on each side:



We can remove 2 units of weight from each side, and the hanger will stay balanced. This is the same as subtracting 2 from each side of the equation.



An equation for the new balanced hanger is  $x = 4$ . This gives the solution to the original equation.



Here is a concise way to write the steps above:

$$3(x + 2) = 18$$

$$x + 2 = 6 \quad \text{after multiplying each side by } \frac{1}{3}$$

$$x = 4 \quad \text{after subtracting 2 from each side}$$