Unit 6, Lesson 8

Reasoning about Solving Equations (Part 2)

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

8.1 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. $2 \cdot x + 3$

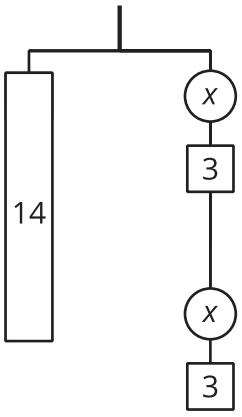
E. $(2 \cdot x) + 3$

F. $(2 + x)3$

8.2 Either Or

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

   $14 = 2(x + 3)$ or
   $14 = 2x + 6$

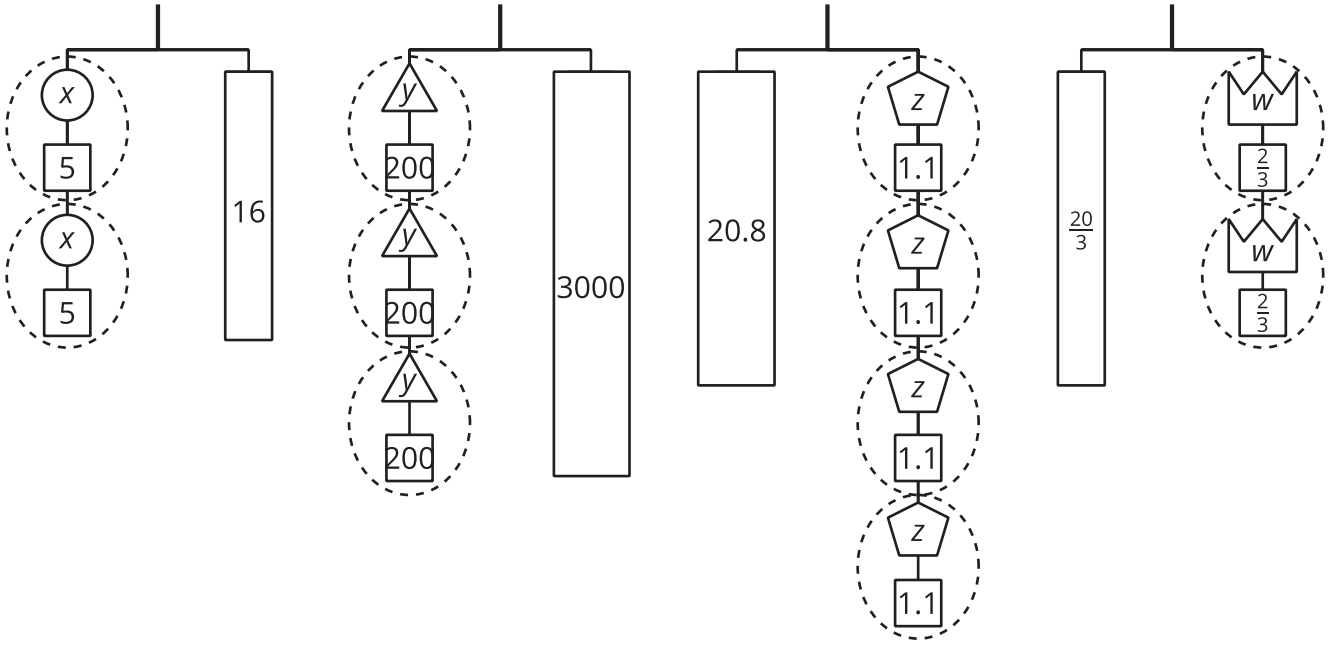


2. Find the weight of one circle. Be prepared to explain your reasoning.

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8.3 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.

$2(x + 5) = 16$

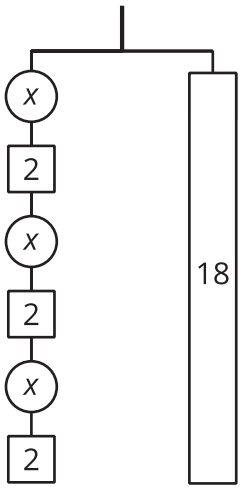
$3(y + 200) = 3{,}000$

$20.8 = 4(z + 1.1)$

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

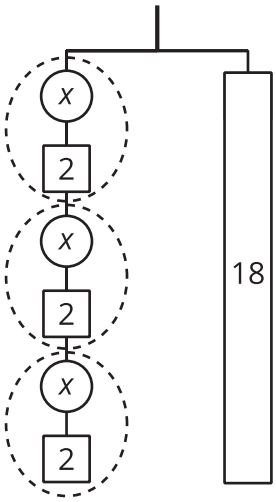
Lesson 8 Summary

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.



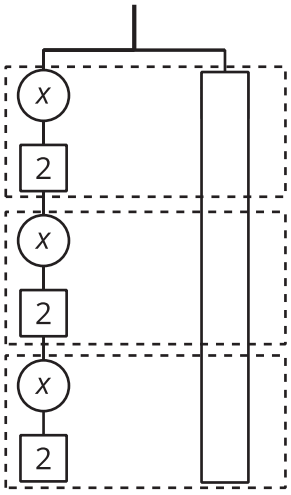
$$\begin{aligned} 3x + 6 &= 18 \\ 3x &= 12 \\ x &= 4 \end{aligned}$$

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



$3(x + 2) = 18$

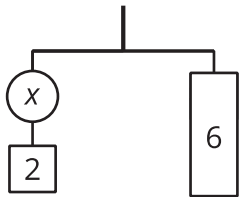
The two sides of the hanger balance with these weights: 3 groups of $x + 2$ on one side, and 18, or 3 groups of 6, on the other side.



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

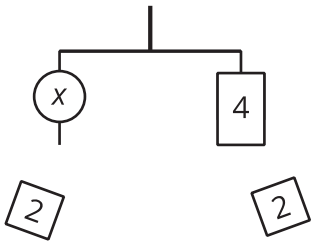
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The two sides of the hanger will balance with $\frac{1}{3}$ of the weight on each side:



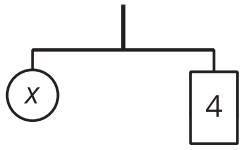
$x + 2 = 6$

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.



$x + 2 - 2 = 6 - 2$

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



$x = 4$

Here is a concise way to write the steps above:

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

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

$x = 4$ after subtracting 2 from each side