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Unit 6, Lesson 8: Reasoning about Solving Equations (Part 2)

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

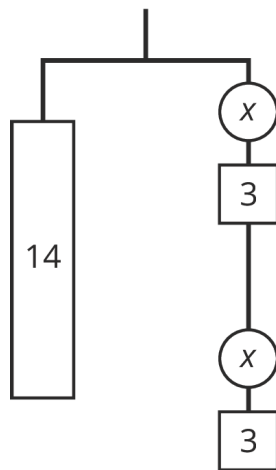
8.1: Equivalent to $2(x + 3)$

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

1. $2 \cdot (x + 3)$
2. $(x + 3)^2$
3. $2 \cdot x + 2 \cdot 3$
4. $2 \cdot x + 3$
5. $(2 \cdot x) + 3$
6. $(2 + x)^3$

8.2: 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.

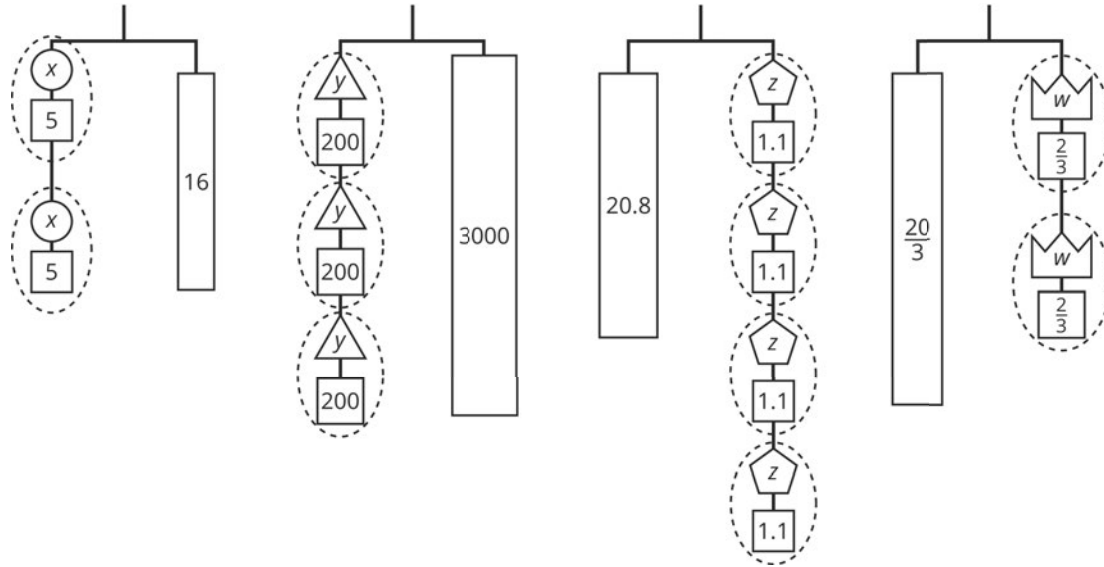
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8.3: Use Hangers to Understand Equation Solving, Again

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



For each diagram:

1. Assign one of these equations to each hanger:

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

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

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

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

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.

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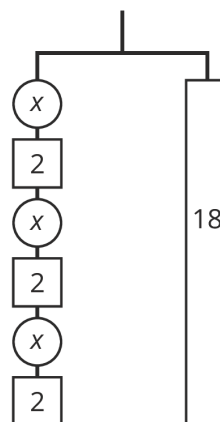
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Lesson 8 Summary

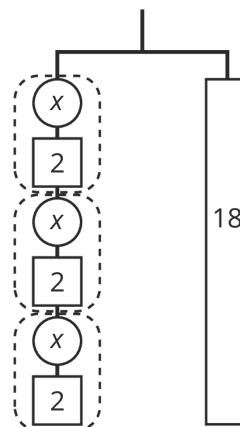
The balanced hanger shows 3 equal, unknown weights and 3 2-unit weights on the left and an 18-unit weight on the right.

There are 3 unknown weights plus 6 units of weight on the left. We could represent this balanced hanger with an equation and solve the equation the same way we did before.

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

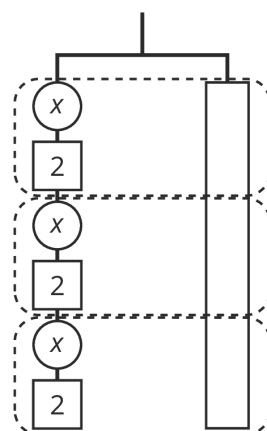


Since there are 3 groups of $x + 2$ on the left, we could represent this hanger with a different equation: $3(x + 2) = 18$.



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

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.



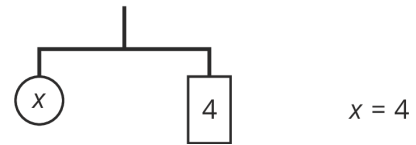
$$3(x + 2) = 18$$

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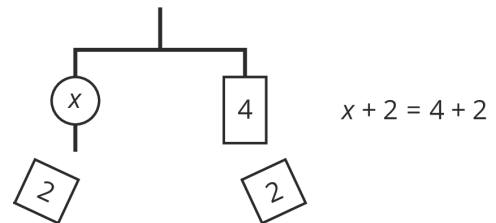
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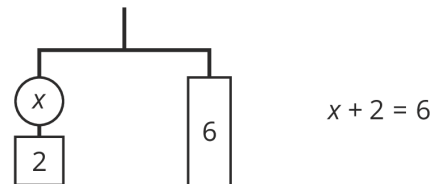
The two sides of the hanger will balance with $\frac{1}{3}$ of the weight on each side: $\frac{1}{3} \cdot 3(x + 2) = \frac{1}{3} \cdot 18$.



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:

$$\begin{array}{ll}
 3(x + 2) = 18 & \\
 x + 2 = 6 & \text{after multiplying each side by } \frac{1}{3} \\
 x = 4 & \text{after subtracting 2 from each side}
 \end{array}$$

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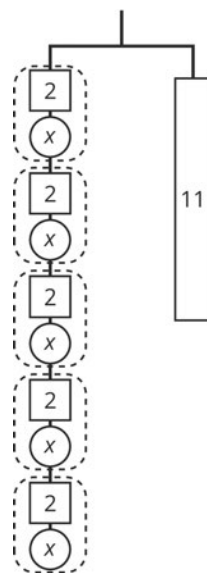
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Unit 6, Lesson 8: Reasoning about Solving Equations (Part 2)

1. Here is a hanger:

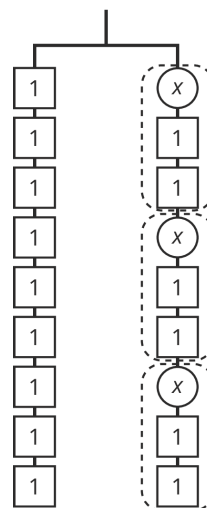
a. Write an equation to represent the hanger.

b. Solve the equation by reasoning about the equation or the hanger. Explain your reasoning.



2. Explain how each part of the equation $9 = 3(x + 2)$ is represented in the hanger.

- x
- 9
- 3
- $x + 2$
- $3(x + 2)$
- the equal sign



3. Select the word from the following list that best describes each situation.

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A. Tax

B. Commission

C. Discount

D. Markup

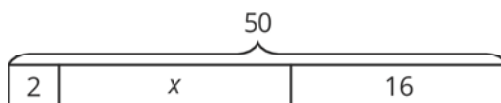
E. Tip or gratuity

F. Interest

1. You deposit money in a savings account, and every year the amount of money in the account increases by 2.5%.
2. For every car sold, a car salesman is paid 6% of the car's price.
3. Someone who eats at a restaurant pays an extra 20% of the food price. This extra money is kept by the person who served the food.
4. An antique furniture store pays \$200 for a chair, adds 50% of that amount, and sells the chair for \$300.
5. The normal price of a mattress is \$600, but it is on sale for 10% off.
6. For any item you purchase in Texas, you pay an additional 6.25% of the item's price to the state government.

(from Unit 4, Lesson 11)

4. Clare drew this diagram to match the equation $2x + 16 = 50$, but she got the wrong solution as a result of using this diagram.



- a. What value for x can be found using the diagram?
- b. Show how to fix Clare's diagram to correctly match the equation.
- c. Use the new diagram to find a correct value for x .

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d. Explain the mistake Clare made when she drew her diagram.

(from Unit 6, Lesson 3)