Lesson 10: Different Options for Solving One Equation

Let's think about which way is easier when we solve equations with parentheses.

10.1: Algebra Talk: Solve Each Equation

$100(x - 3) = 1{,}000$

$500(x - 3) = 5{,}000$

$0.03(x - 3) = 0.3$

$0.72(x + 2) = 7.2$

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10.2: Analyzing Solution Methods

Three students each attempted to solve the equation $2(x-9)=10$, but got different solutions. Here are their methods. Do you agree with any of their methods, and why?

Noah's method:

$$\begin{aligned} 2(x-9) &= 10 && \\ 2(x-9)+9 &= 10+9 && \text{add 9 to each side} \\ 2x &= 19 && \\ 2x \div 2 &= 19 \div 2 && \text{divide each side by 2} \\ x &= \frac{19}{2} && \end{aligned}$$

Elena's method:

$$\begin{aligned} 2(x-9) &= 10 && \\ 2x-18 &= 10 && \text{apply the distributive property} \\ 2x-18-18 &= 10-18 && \text{subtract 18 from each side} \\ 2x &= \text{-}8 && \\ 2x \div 2 &= \text{-}8 \div 2 && \text{divide each side by 2} \\ x &= \text{-}4 && \end{aligned}$$

Andre's method:

$$\begin{aligned} 2(x-9) &= 10 && \\ 2x-18 &= 10 && \text{apply the distributive property} \\ 2x-18+18 &= 10+18 && \text{add 18 to each side} \\ 2x &= 28 && \\ 2x \div 2 &= 28 \div 2 && \text{divide each side by 2} \\ x &= 14 && \end{aligned}$$

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10.3: Solution Pathways

For each equation, try to solve the equation using each method (dividing each side first, or applying the distributive property first). Some equations are easier to solve by one method than the other. When that is the case, stop doing the harder method and write down the reason you stopped.

1. $2{,}000(x - 0.03) = 6{,}000$

2. $2(x + 1.25) = 3.5$

3. $\frac{1}{4}(4 + x) = \frac{4}{3}$

4. $-10(x - 1.7) = -3$

5. $5.4 = 0.3(x + 8)$

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Lesson 10 Summary

Equations can be solved in many ways. In this lesson, we focused on equations with a specific structure, and two specific ways to solve them.

Suppose we are trying to solve the equation $\frac{4}{5}(x + 27) = 16$. Two useful approaches are:

- divide each side by $\frac{4}{5}$
- apply the distributive property

In order to decide which approach is better, we can look at the numbers and think about which would be easier to compute. We notice that $\frac{4}{5} \cdot 27$ will be hard, because 27 isn't divisible by 5. But $16 \div \frac{4}{5}$ gives us $16 \cdot \frac{5}{4}$, and 16 is divisible by 4. Dividing each side by $\frac{4}{5}$ gives:

$$\begin{aligned} \frac{4}{5}(x + 27) &= 16 \\ \frac{5}{4} \cdot \frac{4}{5}(x + 27) &= 16 \cdot \frac{5}{4} \\ x + 27 &= 20 \\ x &= \text{-}7 \end{aligned}$$

Sometimes the calculations are simpler if we first use the distributive property. Let's look at the equation $100(x + 0.06) = 21$. If we first divide each side by 100, we get $\frac{21}{100}$ or 0.21 on the right side of the equation. But if we use the distributive property first, we get an equation that only contains whole numbers.

$$\begin{aligned} 100(x + 0.06) &= 21 \\ 100x + 6 &= 21 \\ 100x &= 15 \\ x &= \frac{15}{100} \end{aligned}$$

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