Let’s play “What’s My Number?”

1. Determine my number, and explain how you came up with the solution.

   If you multiply me by 4, I am 28!
   What’s My Number?

2. Determine my number, and explain how you came up with the solution.

   If you add 13 to me, I am 27!
   What’s My Number?

3. Determine my number, and explain how you came up with the solution.

   If you multiply me by 3 and increase that value by 5, I am 20!
   What’s My Number?

4. How did finding the number in Item 3 compare to finding the numbers in Items 1 and 2?

5. Determine my number and explain how you came up with the solution.
   If you multiply 4 times the sum of 3 and me, and subtract 8 from that value, I am 12! What’s My Number?
6. How did finding the number in Item 5 compare to finding the numbers you found in Items 1 through 3?

7. Write each of the “What’s My Number?” problems as an equation.

You have probably seen different methods to solve equations. Different methods are useful in different situations.

**The Undoing Method**

The undoing method “undoes” or reverses the order of operations in an equation. To solve an equation using the undoing method:
- Create a flowchart to show what happens to the variable. Follow the order of operations.
- On the line below, work backward by doing the inverse operations.

**EXAMPLE 1**

Solve $5(x + 30) - 18 = 17$ using the undoing method. Check your solution.

**Step 1:** Create a flow chart to show what happens to the variable.
Solving Equations with Models
What’s My Number?

SUGGESTED LEARNING STRATEGIES: Think/Pair/Share, Group Discussion, Group Presentation, Work Backward

**ACTIVITY 1.4 continued**

**Step 2:** Work backward, showing the inverse operations.

```
  x   + 30  x + 30   5(x + 30)   5(x + 30) - 18
     =  7       35     17
      = -30   = -23
```

**Step 3:** Check your work by substituting -23 in the original equation.

\[
5(x + 30) - 18 = 17 \\
5(-23 + 30) - 18 = 17 \\
5(7) - 18 = 17 \\
35 - 18 = 17 \\
17 = 17 \text{ This is a true statement, so the solution checks.}
\]

**Solution:** \( x = -23 \)

**TRY THESE A**

**a.** Solve the “What’s My Number?” problem from Item 5 using the undoing method. Check your solution.

Solve each equation using the undoing method.

**b.** \( 20 = 9k + 2 \)  
**c.** \( 0.25x - 6 = 2 \)

**d.** \( \left( \frac{1}{2}m + 3 \right) - 5 = 2 \)  
**e.** \( 27 = \frac{9}{2}(t - 3) \)

**f.** \( \frac{5(x - 7) + 2}{8} = 4 \)  
**g.** \( \frac{12x}{5} + 18 = 36 \)

**8.** Try to solve this “What’s My Number?” problem using the undoing method. What problems do you run into?

If you multiply me by 7, subtract 9, and add twice me to that value, I am 90! What’s My Number?
**SUGGESTED LEARNING STRATEGIES:** Create Representations, Group Presentation

**Algebra-Tiles Method**

The undoing method can be effective to solve equations that have only one variable term. When equations become more complex, you may want to use another method, such as using algebra tiles, to solve.

The tile for $+1$ is $+1$, and the tile for $-1$ is $-1$.
The tile for $x$ is $x$.
The tile for $-x$ is $-x$.

The pairs $(1 \text{ and } -1; x \text{ and } -x)$ are the additive inverses of each other. They are called zero pairs since adding them together yields $0$.

**EXAMPLE 2**

Solve $2x - 5 = 3$ using algebra tiles.

**Step 1:** Represent the equation using a model.

**Step 2:** Add five $+1$ tiles to each side of the equation and use zero pairs to isolate the $x$-tiles.

**Step 3:** Group the tiles in rows equal to the number of $x$-tiles

From the groupings, you can see that each $x$-tile is equal to $4$.

**Solution:** $x = 4$

**TRY THESE B**

a. Solve this problem using algebra tiles: If you multiply $2$ times the sum of $2$ and me, I am $10$! What’s My Number?
TRY THESE (continued)

Use algebra tiles to solve each equation. You can use the My Notes section to draw pictures representing the problems.

b. \( 4 + 5t = 11 + 4t \)  
   c. \( 14 + 3n = 2n \)  
   d. \( 2(y + 1) - 3 = -7 \)

e. \( 4x + 2 = -22 \)  
f. \( -5 = 9 + y \)  
g. \( 2y + 3 + y = 12 \)

9. Solve these two “What’s My Number?” problems. Which of the methods you have seen so far did you use? Why? What are some of the drawbacks of the two methods?

a. If you multiply me by 25 and subtract 37 from that value, I am 113!

b. If you multiply me by \( \frac{1}{2} \) and subtract \( \frac{3}{4} \) from that value, I am \( 3\frac{1}{4} \)!

Balancing Method

The balancing method is useful when the undoing method or algebra tiles are too cumbersome. This method is also called the symbol method or solving equations using symbols. Keep the ideas from the other two methods in mind as you use this new method.

EXAMPLE 3

Solve the equation \( 3x + 90 + 2x = 360 \) using the balancing method. Check your solution.

Step 1: Apply the commutative property.

\[ 3x + 90 + 2x = 360 \]
\[ 3x + 2x + 90 = 360 \]

Step 2: Combine like terms.

\[ 5x + 90 = 360 \]

Step 3: Apply the subtraction property of equality.

\[ 5x + 90 - 90 = 360 - 90 \]
\[ 5x = 270 \]

Step 4: Apply the division property of equality.

\[ \frac{5x}{5} = \frac{270}{5} \]
\[ x = 54 \]

Step 5: Check by substitution.

\[ 3(54) + 90 + 2(54) = 360 \]
\[ 162 + 90 + 108 = 360 \]
\[ 360 = 360 \]

Solution: \( x = 54 \).
TRY THESE C

a. Solve the “What’s My Number?” from Item 5 using the balancing method.

Solve each equation using the balancing method.

b. \(-2x - 6 - 3x = 1\)

c. \(4(x - 2) - 5x = 10\)

d. \(12d + 2 - 3d = 5\)

e. \(8 = 3\left(\frac{1}{2}w - 4\right) + 8\)

f. \(20x - (3 - 5x) = 22\)

g. \(7.4p - 5.3 - 9.2p = -2.6\)

10. How is the balancing method similar to the undoing method and the algebra tiles method? How is it different?

11. You have learned to solve equations using guess and check, algebra tiles, the undoing method, and balancing method. Solve the following equations using any method you have learned.

a. \(2x - 1 + 6x = 87\)

b. \((x - 4)8 = -16\)

c. \(\frac{1}{3}x + 7 = 27\)

5. Use the distributive property to rewrite the following.

a. \(5(x - 3)\)

b. \(-2(x - 5)\)

c. \((7 - x)8\)

6. Solve this equation using the any method. Explain why you chose the method you did.

\(3x + 7 - 9x = 2(8 - 5)\)

7. Which method of solving equations are you most confident in using? Which method do you feel you still have questions about?