

Solving Equations with Variables on Each Side

Explore

On this balance, each bag contains the same number of blocks. The bags weigh almost nothing compared to the blocks.



How many blocks are in each bag? Explain how you found your answer.

Check to make sure your answer is a solution to the puzzle.

Investigation 1 Balance Puzzles

Now it is your turn to draw some balance puzzles to try with your classmates. Here are the rules for creating balance puzzles.

- In any puzzle, all bags must hold the same number of blocks.
- The two sides of the balance must have the same total number of blocks with different combinations of bags and blocks on each side.

Develop & Understand: A

1. Work by yourself to draw a puzzle with no more than 10 blocks on each side of the balance, including the blocks hidden in the bags. Exchange puzzles with your partner. Solve your partner's puzzle.
2. Now draw a more difficult puzzle, using a total of 12 or more blocks on each side. Exchange puzzles with your partner. Solve your partner's puzzle.

Develop & Understand: B

3. Melina and Sancho challenged their classmates to solve this balance puzzle.



- How many blocks are in each bag? Check your solution.
- What strategy did you use to solve the puzzle?

Melina and Sancho's classmates created similar puzzles. Solve each puzzle by finding how many blocks are in each bag.

4. Tanya and Craig's puzzle



5. Margaret and Aida's puzzle



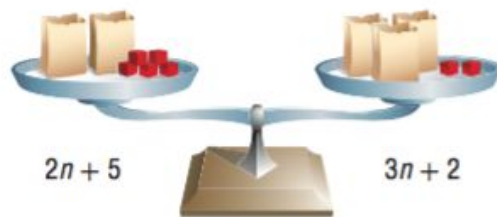
You can write algebraic *equations* to describe balance puzzles.

Example

Here is how Meg made a balance puzzle.

On this side, Meg put 2 bags of blocks and 5 single blocks. If n stands for the number of blocks in each bag, then the number of blocks in “two bags and five blocks” is $2n + 5$.

On this side, Meg put 3 bags of blocks and 2 single blocks. The number of blocks in “three bags and two blocks” is $3n + 2$.



Since the sides balance, the number of blocks on the left, $2n + 5$, is equal to the number of blocks on the right, $3n + 2$. This can be expressed with the following equation.

$$2n + 5 = 3n + 2$$

When you find the number of blocks in each bag, you have found the value of n .

Develop & Understand: B

3. Look at Meg's balance.
 - a. Find the number of blocks in each bag.
 - b. Check that your answer is a solution of the equation $2n + 5 = 3n + 2$.

4. Nguyen created this balance puzzle.



- a. Let b stand for the number of blocks in each bag. Write an equation that fits Nguyen's balance puzzle.
- b. Use the drawing to help you find the value of b .
- c. Check that your answer to Part b is a solution of your equation.

Think & Discuss

Shada created this balance puzzle.



- Write an equation to represent Shada's puzzle.
- How many blocks are in each bag?
- Check that your answer is a solution of your equation.

Develop & Understand: A

1. Consider the equation $3n + 8 = 5n + 2$.
 - a. Draw a balance puzzle to represent the equation. Explain how you know your puzzle matches the equation.
 - b. Use your puzzle to solve the equation. Check your solution by substituting it into the equation.

Miriam said, "I am thinking of a number. If I multiply my number by 6 and add 5, I get the same result as when I multiply it by 3 and add 17."

- a. Use M to represent Miriam's number. Write an equation you could solve to find the value of M .
- b. Solve your equation by imagining a balance puzzle. Check your solution.

Benito said, "I am thinking of a number. If I add 3 to my number, I get the same result as when I multiply it by 4 and add 21."

- a. Use m to represent Benito's number. Write an equation you could solve to find the value of m .
- b. Solve your equation by imagining a balance puzzle. Check your solution.

Sareeta and her brother Rashid put stickers in bags to give away at Sareeta's birthday party. They started with an equal number of stickers and put the same number in each bag. Sareeta filled five bags and had one sticker left. Rashid filled four bags and had seven stickers left.

- a.** Let n represent the number of stickers in a bag. Write an expression that describes the way Sareeta distributed her stickers.
- b.** Write an expression that describes Rashid's four bags and seven extra stickers.
- c.** Because Sareeta and Rashid started with the same number of stickers, it is possible to balance their distributions of stickers. Draw a balance puzzle to show this.
- d.** Write an equation that matches your balance puzzle.
- e.** Use your balance puzzle to find how many stickers are in each bag.

Consider the equation $2v + 50 = 7v + 30$.

- a.** Describe a situation that matches this equation.
- b.** Find the value of v . Check your solution.
- c.** Explain what your solution means in terms of the situation you described in Part a.