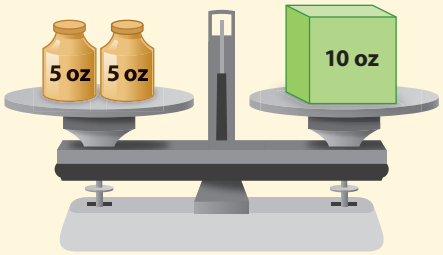
Understand Solutions to Equations

Think It Through

What does it mean to solve an equation?

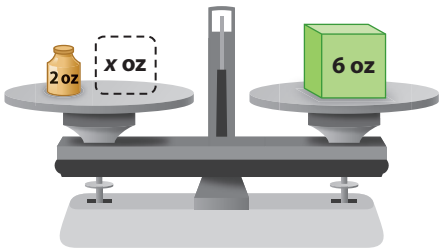
Have you ever seen a pan balance? You put objects in both pans. If the objects' weights are the same, the pans hang evenly.



An equation is like a pan balance. A pan balance tells you two weights are equivalent. An equation tells you two expressions are equivalent.

Think **Solving an equation is like making the pans of a balance hang evenly.**

Imagine a pan balance like the one below.



Look at the picture. **Circle** the weights that must combine to equal 6 ounces.

The pans are hanging evenly, so the total weight in each pan is the same. The pan on the right holds 6 ounces. The pan on the left must also hold 6 ounces.

How much weight do you have to add to 2 ounces to get a total of 6 ounces? 2 ounces and 4 ounces together are a total of 6 ounces. Therefore, the unknown weight, *x*, must be 4 ounces.

Think **Solving an equation is finding out how to make two expressions equivalent.**

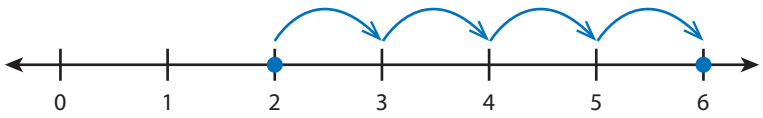
Write an expression for the weight in the right-side pan: 6.

An **equation** is a statement that tells you two expressions are equivalent.

$2 + x = 6$ is an equation.

"Solve the equation" means you need to find the value of the variable that will make the expression $2 + x$ equivalent to 6.

What number can you add to 2 to get 6?



Write an expression for the weight in the left-side pan: $2 + x$.

Adding 4 to 2 gives a total of 6. So, the solution of $2 + x = 6$ is that x must be equal to 4.

Reflect

1 What would the balance look like if you replace the unknown weight with an 8-ounce weight?

Explain why the solution of $2 + x = 6$ cannot be that x is equal to 8.

Think About Writing and Solving Equations

Let's Explore the Idea

Explore writing and solving equations with the problem below.

Andres buys 3 boxes of markers. Each box has the same number of markers. Andres now has 15 markers. Write and solve an equation to find how many markers are in one box.

2 Choose a variable to represent the number of markers in one box. _____

3 Write an expression to describe the total markers in 3 boxes. _____

4 How many markers does Andres have in all? _____

5 Write an equation that compares your answers from problems 3 and 4. _____

Use a bar model to help you solve the equation.

6 Draw a bar model to represent your equation from problem 5.

7 What number could you multiply by 3 to get 15? _____

8 What is the solution to your equation? _____

9 How many markers are in each box? _____

Now try these two problems.

10 At noon the temperature on Jessica's porch was 75° F. Then the temperature dropped *d* degrees. By midnight, the temperature on the porch was 63° F. Write an equation with an expression equivalent to the temperature at midnight. _____

11 By how many degrees did the temperature drop between noon and midnight? What is the solution to your equation?

_____

_____

Let's Talk About It **Solve the problem below as a group.**

Marta earns $12.50 from babysitting, and then spends some of her earnings on a new book. She has $8.00 of her earnings left. Write and solve an equation to find the cost of the book.

12 What is the unknown amount? _____ Choose a variable to represent it. _____

13 Could the value of the variable be greater than $12.50? Explain.

_____

_____

14 Write an equation with an expression equivalent to $8.00. _____

15 Draw a number line from 7.5 to 13.5.

16 What number can you subtract from 12.5 to get 8? _____

17 What is the solution of your equation? _____

18 What is the cost of the book? _____

Try It Another Way **Explore using math tiles to solve an equation.**

19 Write your equation from problem 14. _____

20 Use math tiles to represent the equation.

21 What amount can you subtract from $12.50 to get $8.00? _____

22 What is the cost of the book? _____

Connect Writing and Solving Equations

Talk through these problems as a class, then write your answers below.

23 Analyze Explain why the solution to $3r = 2$ must be less than 1.

24 Illustrate Use a bar model to illustrate the equation $20 - x = 6$. Explain how you would solve the equation.

25 Create Write a real-world problem that you could represent with the equation $3 + x = 10$. Solve the equation to find the answer to your problem.

Apply Writing and Solving Equations

26 Put It Together Imagine you have a pan balance. The left pan holds a bag with an unknown number of identical blocks and 10 more blocks you can see. Assume the bag itself has no weight. The other pan is empty.

Part A Draw a picture of what the balance would look like in this situation.

Part B Suppose you put 13 identical blocks in the right-side pan and this makes the pans hang evenly. Draw a picture of the balance. What equation does this represent?

Part C Suppose you take 10 blocks out of each pan. Draw a picture of the balance. What does the number of blocks in the right-side pan tell you? Explain how you know.