



Balance Scale Solver

Mission: Mystery bags each hold the same number of blocks. Keep the scale balanced while you remove and split blocks, and you'll discover the hidden number, which is exactly how equations are solved.

Big question: How does keeping a balance help us solve equations?

★ Warm-up: Mystery number

Find the mystery number and explain how.

$$? + 3 = 8 \quad \checkmark \quad \mathbf{5.}$$

$$3 \times ? = 12 \quad \checkmark \quad \mathbf{4.}$$

Key vocabulary

Equation	A statement that two expressions are equal (it balances).
Variable	A letter, like x, for an unknown number.
Inverse operation	An operation that undoes another (– undoes +, ÷ undoes ×).
Solution	The value that makes the equation true.

1 Box 1

Solve it fairly

In the simulator: Solve $x + 3 = 8$ by keeping the scale balanced the whole time.

What is x?

Answer: _____ $\checkmark \quad \mathbf{5}$

2 Box 2

$$3x = 12$$

In the simulator: Solve $3x = 12$.

Which move solved it?

☐ Split both sides into 3 equal groups (divide by 3) ☐ Take 3 blocks off both sides ☐ Add 3 to both sides

$\checkmark$ **Split both sides into 3 equal groups (divide by 3)**

3 Box 3

$$2x + 5 = 17$$

In the simulator: Solve $2x + 5 = 17$.

Put your moves in order.

Put in order: Check: $2 \times 6 + 5 = 17 \quad \checkmark$ · Split both sides into 2 groups $\rightarrow x = 6$ · Take 5 blocks off both sides $\rightarrow 2x = 12$

1. **Take 5 blocks off both sides $\rightarrow 2x = 12$**

2. **Split both sides into 2 groups $\rightarrow x = 6$**

3. **Check: $2 \times 6 + 5 = 17 \quad \checkmark$**

4 Box 4

Check the solution

How can you CHECK that $x = 6$ is right for $2x + 5 = 17$?

☐ Put 6 in for x : $2(6) + 5 = 17$, true ☐ Ask a friend ☐ x is always 6

✓ Put 6 in for x : $2(6) + 5 = 17$, true

5 Box 5

$$4x + 2 = 22$$

In the simulator: Solve $4x + 2 = 22$.

$x = ?$

Answer: _____ ✓ 5

Show your thinking:

6 Box 6

Legend: no scale 🏆 Legend only

Solve without the scale: $7x + 9 = 65$.

Answer: _____ ✓ 8

Show your thinking:

7 Box 7

Explain the rule

Explain why you must do the same thing to both sides of an equation.

Look for: Mentions both sides; Keeps it equal/balanced

Exit ticket: answer the big question in your own words

How does keeping a balance help us solve equations?

Look for: An equation is like a balanced scale. Whatever you do to one side, you must do to the other to keep it balanced. Subtracting the same amount from both sides, or dividing both sides into the same number of equal groups, gets x alone.

Completion codes

Students see a code like **ABC-I3** when they finish. The first part must match below. The letter is the level (E = Explorer, I = Investigator, L = Legend), and the number at the end is how many stars they earned.

Level	Code starts with
 Explorer	SF5-E
 Investigator	B75-I

 Watch for these misconceptions

- "3x means $3 + x$." It means 3 times x.
- "Do the operation you see." Use the inverse operation to undo it.
- "Only change one side of the equation." Whatever you do to one side, do to the other.