

Grade 8 · Solving Linear Equations · Lesson

Common Core 8.EE.C.7a, 8.EE.C.7b · mathovore.fr

A linear equation in one variable can have one solution, no solution, or infinitely many solutions. To solve one, distribute, combine like terms, collect the variable terms on one side, and undo the operations. Then check your answer by substituting it into the original equation.

Grade 8 Common Core: 8.EE.C.7a · 8.EE.C.7b

Key facts:

- Standards 8.EE.C.7a and 8.EE.C.7b: solve linear equations with rational coefficients, and decide how many solutions an equation has.
- Use the distributive property, $a(b+c) = ab+ac$, and combine like terms before moving terms across.
- Do the same operation to both sides to keep the equation balanced.
- A false result like $3=7$ means no solution; a true result like $6=6$ means infinitely many solutions.
- Always check by substituting the solution into the original equation.

What is a linear equation?

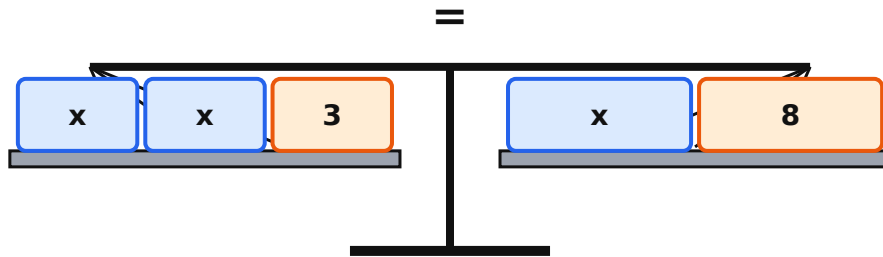
A **linear equation in one variable** can be written with x to the first power only, such as $2x+3=x+8$. To solve it, find the value of x that makes both sides equal. Coefficients may be fractions, decimals or negative numbers.

Vocabulary

Like terms: terms with the same variable part, such as $3x$ and $-5x$, or plain numbers.

Distributive property: $a(b+c) = ab+ac$.

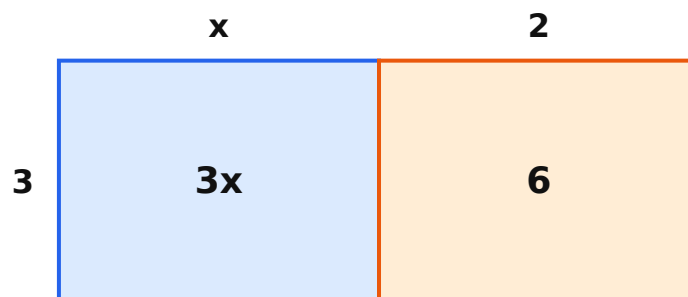
Inverse operations: addition and subtraction undo each other, and so do multiplication and division.



The equation $2x+3=x+8$ as a balance. Remove one x and 3 from each pan: $x=5$.

How do you solve an equation with variables on both sides?

1. Distribute to remove parentheses.
2. Combine like terms on each side.
3. Add or subtract to collect the variable terms on one side and the numbers on the other.
4. Divide both sides by the coefficient of the variable.
5. Check by substituting the answer into the original equation.



The distributive property: $3(x+2)=3x+6$.

Worked example. Solve $4(x-1)+2=2x+10$. Distribute: $4x-4+2=2x+10$. Combine: $4x-2=2x+10$. Subtract $2x$: $2x-2=10$. Add 2: $2x=12$. Divide by 2: $x=6$. Check: $4(5)+2=22$ and $2(6)+10=22$.



Distribute and combine like terms, then collect the variable terms, then isolate x .

How do you handle fractions and decimals?

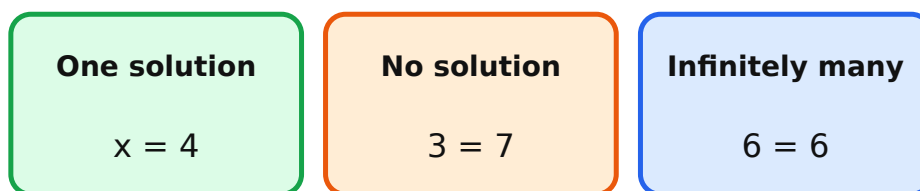
You have two options. You can work with the fractions directly, multiplying by a reciprocal at the end. Or you can multiply every term on both sides by the least common denominator to clear the fractions first. For $\frac{1}{2}x-3=\frac{1}{4}x+2$, multiplying every term by 4 gives $2x-12=x+8$, so $x=20$. With decimals, multiply by 10 or 100 in the same way. Whichever

method you choose, always check the answer in the original equation, because a small sign error is easy to miss.

How many solutions can an equation have?

Simplify until the variable terms are alike. Then read the result. If you get $x =$ a number, there is **one solution**. If the variable disappears and the statement is false, like $3 = 7$, there is **no solution**. If it disappears and the statement is true, like $6 = 6$, there are **infinitely many solutions**.

For example, $4x+3=4x+7$ gives $3=7$, so it has no solution. And $5x+5=5(x+1)$ gives $5=5$, so every number works.



What the last line tells you.

Solving Linear Equations: frequently asked questions

How do you solve an equation with variables on both sides?

Subtract the smaller variable term from both sides so the variable is on one side only, then solve the remaining two-step equation. For $5x+4=3x+16$, subtract $3x$ to get $2x+4=16$, so $x=6$.

What does it mean when the variable disappears?

The variable terms cancelled, so only numbers are left. If the numbers make a false statement like $3 = 7$, there is no solution. If they make a true statement like $6 = 6$, every number is a solution.

How do you solve equations with fractions?

You can multiply every term by the least common denominator to clear the fractions, or work with the fractions directly. For $\frac{1}{2}x-3=\frac{1}{4}x+2$, multiplying by 4 gives $2x-12=x+8$, so $x=20$.

Why do you distribute before combining like terms?

Parentheses hide terms that can only be combined after the multiplication is done. In $3x+2(x-4)$, distributing gives $3x+2x-8$, which combines to $5x-8$.

How do you check a solution?

Substitute the value for the variable in the original equation and simplify each side. If both sides are equal, the solution is correct. For $x=6$ in $4x+7=31$, $4(6)+7=31$.