ALGEBRA / 01 UNDERSTAND

Linear equations

An illustrated lesson ▪ Theory, reasoning and worked examples

An equation is a claim of equality

An equation says that the expressions on its two sides have the same value. A solution is a value of the variable that makes that statement true. In 3x + 6 = 21, the left side changes when x changes, while the right side stays fixed. Solving means finding the input that makes the two sides match; it does not mean moving symbols by guesswork.

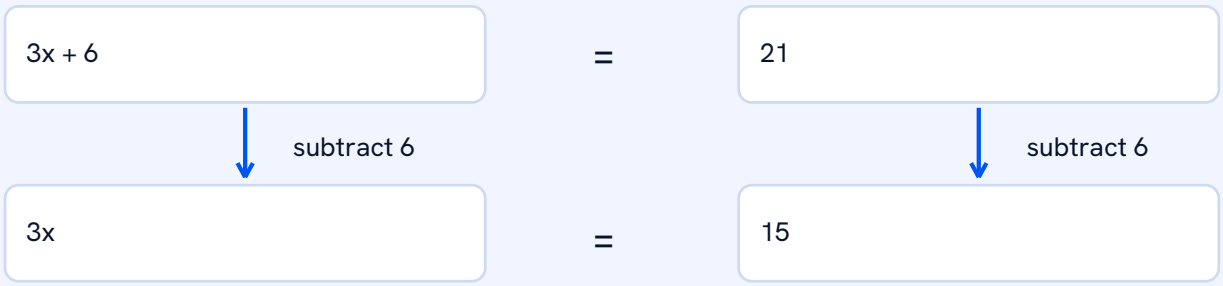
Equivalent equations preserve the solution

Adding the same number to both sides, or multiplying both sides by the same nonzero number, preserves equality. This is why subtracting 6 from both sides is valid. Dividing both sides by 3 is also valid. Think of each step as replacing the original statement with a simpler statement that is true for exactly the same values of x.

Expressions are not equations

You simplify an expression such as 3x + 6; you solve an equation such as 3x + 6 = 21. If a question asks for 3x rather than x, stop when you know that quantity. Keeping the requested expression visible often saves a step and prevents answering a different question.

EQUALITY SURVIVES THE SAME OPERATION ON BOTH SIDES



Illustrative teaching diagram. Values and examples are explained in the lesson.

THE ESSENTIAL IDEA

Keep both sides equal while isolating the unknown.

ALGEBRA / 02 BUILD THE METHOD

From idea to method

Choose the first operation

Simplify each side before isolating the variable. Distribute a multiplier to every term inside parentheses, then combine like terms. If variables occur on both sides, subtract one variable term from both sides. Keep the equality sign on every line so the reasoning remains visible.

Handle fractions deliberately

Multiplying every term by a common denominator removes fractions. For $x/3 + 2 = 7$, multiplying the entire equation by 3 gives $x + 6 = 21$. Multiplying only $x/3$ and leaving the other terms unchanged creates a different equation. Never divide by an expression that could be zero without considering that case.

Recognize the three outcomes

A single value such as $x = 5$ gives one solution. A true statement such as $0 = 0$ after the variable cancels means every permitted value works. A false statement such as $0 = 4$ means no solution. Cancellation alone does not tell you which of these last two cases applies.

WORKED EXAMPLE / VARIABLES ON BOTH SIDES

Solve $4(x - 2) = 2x + 10$.

01 Set up the reasoning

Distribute: $4x - 8 = 2x + 10$. The factor 4 multiplies both x and -2.

02 Apply the relationship

Subtract $2x$ from both sides: $2x - 8 = 10$. Add 8 to both sides: $2x = 18$.

03 Interpret and check

Divide by 2: $x = 9$. Substitute: $4(9 - 2) = 28$ and $2(9) + 10 = 28$. Both sides agree.

Keep these distinctions handy

One solution	$ax + b = c$, $a \neq 0$: isolate $x = (c - b)/a$.
No solution	The variable cancels and leaves a false statement.
All permitted values	The variable cancels and leaves a true statement.

ALGEBRA / 03 CONNECT & REMEMBER

See the deeper pattern

When a coefficient depends on a parameter

In ax + b = cx + d, rearranging gives (a - c)x = d - b. If a and c differ, there is one solution. If they are equal, inspect b and d: equal constants give infinitely many solutions; unequal constants give none. This is the same equality principle, applied to a family of equations rather than one numerical example.

ONE MORE WORKED APPLICATION

If 5x + 7 = 77, what is x?

1. Subtract 7: 5x = 70.

2. Divide by 5: x = 14.

3. Check: 5(14) + 7 = 77.

Answer: 14

Mistakes to recognize

- Writing 4(x - 2) as 4x - 2 loses the multiplication of the constant.
- Changing the sign of a term is shorthand for an operation on both sides, not a separate rule.
- Check the original equation, especially after clearing denominators.

A quick understanding check

Why is subtracting 6 from only one side invalid?

Explanation: It changes just one expression, so the two sides need not remain equal.

MORE PRACTICE IN YOUR DASHBOARD

Open prepvora.com/app/ and use the SAT question bank. Work on Algebra, then look for linear equations questions. Solve independently before reviewing the explanation. Use this guide for the theory; use the dashboard for a longer practice session.

Open your dashboard → | Explore the resource library →

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