

Algebra 1 - Linear Inequalities in One Variable - Lesson

Common Core A-REI.B.3, A-CED.A.1 · maths-pdf.fr/en/

A linear inequality compares two expressions using $<$, $>$, $\leq$, or $\geq$, and it has infinitely many solutions that are shown on a number line. Solve it like an equation, but reverse the inequality symbol whenever you multiply or divide both sides by a negative number. Compound inequalities join two conditions with and or or.

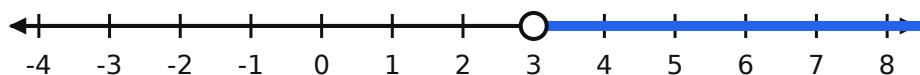
Algebra 1 · Common Core State Standards: **A-REI.B.3, A-CED.A.1**

Key facts

- Use an open circle for $<$ and $>$, and a closed circle for $\leq$ and $\geq$.
- Adding or subtracting the same number never changes the inequality symbol.
- Multiplying or dividing both sides by a negative number reverses the symbol.
- An and inequality is true between endpoints; an or inequality is true on two rays.
- “At least” means $\geq$ and “at most” means $\leq$.

What is a linear inequality?

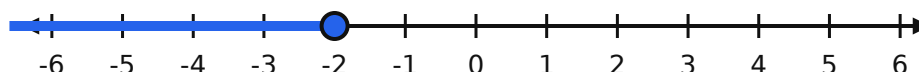
A **linear inequality** compares two expressions with $<$, $>$, $\leq$, or $\geq$ instead of an equals sign. Its solution set is every value of the variable that makes the statement true. There are usually infinitely many solutions, so we show them on a number line.



Graph of $x > 3$: open circle at 3, ray to the right.

Open and closed circles

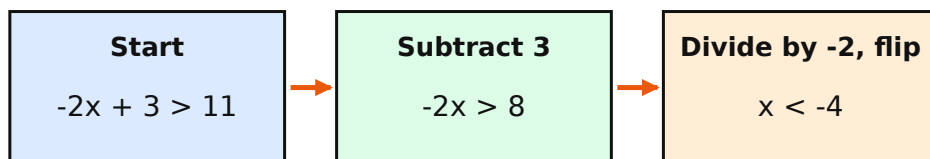
Use an **open circle** for $<$ and $>$ because the endpoint is not a solution. Use a **closed circle** for $\leq$ and $\geq$ because the endpoint is a solution. The ray points toward the solutions.



Graph of $x \leq -2$: closed circle at -2, ray to the left.

How do you solve an inequality?

Solve it like an equation, with one important exception. Adding or subtracting the same number on both sides never changes the symbol. Multiplying or dividing both sides by a **negative** number reverses the symbol.



Dividing by a negative number reverses the inequality symbol.

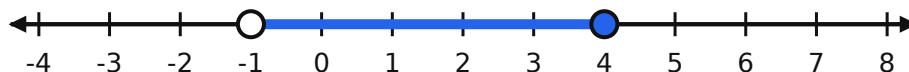
1. Distribute and combine like terms on each side.
2. Move variable terms to one side and constants to the other.
3. Divide or multiply to isolate the variable. If the number is negative, flip the symbol.
4. Graph the solution and check one test value.

Example: Solve $-2x+3>11$. Subtract 3: $-2x>8$. Divide by -2 and reverse the symbol: $x<-4$. Test $x=-5$: $-2(-5)+3=13>11$, which is true.

Why does the symbol flip? Start with the true statement $2<5$. Multiply both sides by -1 : you get $-2>-5$, so the order reversed. Negative numbers sit in the opposite order on the number line, which is why a negative multiplier or divisor reverses the symbol. Always check your answer with a test value.

What is a compound inequality?

A compound inequality joins two inequalities. An **and** inequality, such as $-1<x\leq 4$, is true between the endpoints. An **or** inequality, such as $x<-2$ or $x\geq 4$, is true on either of two separate rays.



How do you write an inequality from a situation?

Look for phrases. "At most" and "no more than" mean $\leq$. "At least" means $\geq$. If a student has \$60 and each smoothie costs \$4.50, the number of smoothies s satisfies $4.50s \leq 60$.

Tip: Always test one value from your solution set in the original inequality, and test the endpoint too. This catches a forgotten sign reversal right away.

Questions about linear inequalities in one variable

When do you flip the inequality sign?

Flip the sign only when you multiply or divide both sides by a negative number. For $-2x > 8$, dividing by -2 gives $x < -4$.

What is the difference between an open and a closed circle?

An open circle means the endpoint is not part of the solution ($<$ or $>$). A closed circle means it is included ($\leq$ or $\geq$).

How can you check an inequality solution?

Pick a test value from the solution set and substitute it into the original inequality. If the statement is true, the set is likely correct. Also test the endpoint.

What does 'at least' mean?

At least means greater than or equal to. If you need at least \$200, then the amount satisfies $\text{amount} \geq 200$.

How is an and inequality different from an or inequality?

An and inequality such as $-1 < x \leq 4$ requires both conditions at once and gives a segment. An or inequality needs only one condition and gives two separate rays.