Solving Inequalities by Substitution

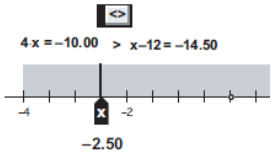
To solve an equation with one variable, you find the number(s) that can be substituted for the variable in that equation. If the substituted number makes the equation true, then it is a solution. You can solve inequalities the same way, but the solution is usually a continuous range of numbers, not just one or two.

SUBSTITUTION ON THE NUMBER LINE

A crude way to solve an inequality would be to substitute every possible number for x and see which ones satisfy the inequality. You can't do this for infinitely many real numbers. However, with a computer you can check many numbers quickly.

1. Open **Inequalities by Substitution.gsp.**

This sketch shows the inequality $4x > x - 12$. Marker x is on a number line, and its value is substituted into two calculations: $4x$ on the left and $x - 12$ on the right. Depending on the value of x, the inequality may be true or it may be false.



Q1 Drag marker x across the screen. For certain values of x, a red line segment appears above the point. What does the red line segment indicate?

To turn on tracing for the segment, select it and choose **Display | Trace Segment.**

2. Mark the interval on which x satisfies the inequality by turning on tracing for the segment and dragging the point along the number line.

Q2 What values of x satisfy the inequality $4x > x - 12$?

3. To edit a calculation, double-click it. To enter x in the Calculator, click the value of x in the sketch. To change the direction of the inequality, press the button above the inequality sign. To erase old traces, press the *Erase Traces* button.

Q3 Edit the calculations and find the solution sets to these inequalities:

a. $2x + 13 < 6x - 7$ b. $5 - 3x < 4 - 4x$

NONLINEAR INEQUALITIES

Your computer helps you do some amazing things, but it can also limit you if you depend on it too heavily. Numbers may be too big to fit on the screen, and details can be too small to notice.

To adjust the scale, drag one of the tick mark numbers below the number line.

Q4 Try to find solutions to these nonlinear inequalities, then adjust the number line scale and see if you missed anything.

a. $240 - 20x^2 < x^3 + 76x$ b. $10000x^3 > x$