Solving Linear Inequalities

Unlike a linear equation, a linear inequality does not have an equal sign, but an inequality sign: $<$ $>$ $\leq$ $\geq$. The inequality sign will lead us to an infinite number of solutions. The solutions are written in ***set interval notation*** which may include the use of negative infinity $-\infty$ or positive infinity ∞.

Symbol	Meaning	Character Used for Set Interval Notation
$<$	Less than	( )
$>$	Greater than	( )
$\leq$	Less than or equal to	[ ]
$\geq$	Greater than or equal to	[ ]

You will solve a linear inequality the same way you solve an equation. The only difference is if you divide in your last step by a negative number. When you divide by a negative number, the inequality sign will flip to the opposite direction.

Solve:

Inequality	Meaning of Answer	Set Interval Notation
$2x-3>9$ $2x>12$ $x>6$	The answer is x "is greater than" 6. Graph the answer on a number line to help visualize the set interval notation.	(6, ∞)
$3x+7\geq -2$ $3x\geq -9$ $x\geq 3$	This answer means x "is greater than or equal to" 3. That means that 3 is included in the answer set.	[3, ∞)
$-5x+3\geq 2x+24$ $-7x\geq 21$ $x\leq -3$	This answer means x "is less than or equation to" -3. Since the inequality sign is $\leq$ we will use brackets to put it into set interval notation.	(-∞, -3)

Problems to try:

1. $3x + 7 > 19$
2. $-4x - 3 \leq 2x + 5$
3. $6(x - 3) + 4 < 2(x + 4) - 6$

Answers on other side.

$3x + 7 > 19$

1. $3x > 12$ $(4, \infty)$

   $x > 4$

$-4x - 3 \leq 2x + 5$

$-6x \leq 8$

2. $x \geq -\frac{8}{6}$ $[-\frac{4}{3}, \infty)$ (Division by negative number. Flip sign.)

   $x \geq -\frac{4}{3}$

$6(x - 3) + 4 < 2(x + 4) - 6$

$6x - 18 + 4 < 2x + 8 - 6$

3. $6x - 14 < 2x + 2$ $(-\infty, 4)$

   $4x < 16$

   $x < 4$