

Linear Inequalities

Linear Inequalities

A linear inequality is an inequality that contains an algebraic expression of degree 1.

Examples

$$3x - 1 < 8$$

$$5x + 3 \geq 6x - 2$$

$$30 \leq 3(2x + 4) - 2(x + 1) \leq 46$$

We can solve linear inequalities similar to the way we solve linear equations.



Let's compare...

Solve:

<u>Equation</u>	<u>Inequality</u>
$3x - 1 = 8$	$3x - 1 < 8$
$3x = 8 + 1$	$3x < 8 + 1$
$3x = 9$	$3x < 9$
$x = \frac{9}{3}$	$x < \frac{9}{3}$
$x = 3$	$x < 3$

Equation

$$x = 3$$

Inequality

$$x < 3$$

Notice that there is only one number that satisfies the equation (3), but there are many numbers that satisfy the inequality (any real number less than 3).

We can also represent the solution to our inequality in the following ways:

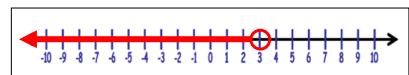
Set Notation

$$\{x \in \mathbb{R} \mid x < 3\}$$

Interval Notation

$$x \in (-\infty, 3)$$

Number Line



A seemingly harmless example...

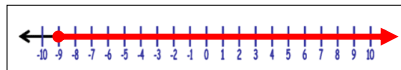
Solve $-3x - 27 \leq 0$

$$-3x - 27 \leq 0$$

$$-3x \leq 27$$

$$x \geq \frac{27}{-3}$$

$$x \geq -9$$



Therefore,

$$\{x \in \mathbb{R} \mid x \geq -9\} \text{ or } x \in [-9, \infty)$$

Why do we reverse the inequality sign when we divide (or multiply) both sides by a negative number?

Practice

Solve the following inequalities on a separate page.

a) $14(2x - 3) \leq 42$

b) $-5(x - 3) \geq 2(x + 5)$

c) $22 < 2x - 8 < 54$

d) $x - 29 < 4x - 5 < x + 12$

e) $2x + 5 \leq 4x - 1 \leq 5x + 6$

f) $|2x + 3| > 8$

g) $|4x - 1| \leq 8$

