

# Linear inequalities

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## Solving linear inequalities

An inequality is like an equation, except it has  $\leq$ ,  $\geq$ ,  $<$ , or  $>$  instead of an equals sign.

A linear inequality is one in which all the terms are either  $x$  with a coefficient or constant terms. For example:  $3x - 1 > 4$ , or  $\frac{x}{3} + 4 \leq 3x - 2$ , etc.

To solve a linear inequality, we need to isolate the variable (usually  $x$ ). The thing that's different compared to solving equations is that here we're not allowed to multiply or divide both sides by a negative number. If we want to do that, we have to flip the direction of the inequality sign. However, it's safer to just not do it at all and instead move terms to the other side so you can divide by positive numbers.

## Examples

#1.  $3x - 2 \geq 6x + 10$

$$-12 \geq 3x$$

$$-4 \geq x$$

Which is the same as  $x \leq -4$ .

#2.  $\frac{3x}{4} + 1 > 2x + 4$

$$-3 > \frac{5x}{4}$$

$$\frac{-12}{5} > x$$

$$\text{So } x < -\frac{12}{5}$$

#3.  $10x \leq 30 - 4x$

$$14x \leq 30$$

$$x \leq \frac{30}{14}$$

$$x \leq \frac{15}{7}$$

## Exercises (solutions on next page)

#1.  $-7x < 3x + 15$

#2.  $\frac{3}{4}x + 5 \geq \frac{5}{2}$

#3.  $-4x > 7$

#4.  $-x - 3 \geq -\frac{2}{3}x + 5$

#5.  $4x + 6 < -3x + 4$

## Solutions

$$\#1. -7x < 3x + 15$$

$$-15 < 10x$$

$$-\frac{3}{2} < x$$

You can leave the answer like this, or rewrite it as  $x > -\frac{3}{2}$

$$\#2. \frac{3}{4}x + 5 \geq \frac{5}{2}$$

$$\frac{3}{4}x \geq -\frac{5}{2}$$

$$x \geq -\frac{10}{3}$$

$$\#3. -4x > 7$$

$$-7 > 4x$$

$$-\frac{7}{4} > x$$

$$\text{So } x < -\frac{7}{4}$$

$$\#4. -x - 3 \geq -\frac{2}{3}x + 5$$

$$-8 \geq \frac{1}{3}x$$

$$-24 \geq x$$

$$\#5. 4x + 6 < -3x + 4$$

$$7x < -2$$

$$x < -\frac{2}{7}$$