

Solving Linear Inequalities

Steps to follow...

1. Simplifying the left and right side of the inequality as two separate expressions.
2. Move the variables to the same side of the inequality symbol, using opposite operations.
Suggestion: move the variable with the smaller coefficient
3. Move all numbers away from the variable, with opposite operations.
 - a. Take care of addition and subtraction first
 - b. Take care of multiplication and division second
 - c. Special Note: When you multiply or divide by a negative number, you have to flip over the inequality symbol.
4. We usually write the final answer with the variable on the left side of the inequality symbol. You might want to flip the entire answer over to accomplish this. In order to avoid making a mistake, make sure that the inequality symbol still points towards or away from the variable before and after you flip the final answer.

Opposite Operations

1. Addition \leftrightarrow Subtraction
2. Multiplication \leftrightarrow Division

Remember:

$$x \leftrightarrow 1x$$

$$-x \leftrightarrow -1x$$

Solve each Inequality.

$$1. \quad 3(4-x) \leq -2x-7$$

$$12 - 3x \leq -2x-7$$

$$\begin{array}{r} +3x \quad | +3x \\ \hline 12 \leq | x-7 \\ +7 \quad \quad | +7 \\ \hline 19 \leq | x \end{array}$$

$$19 \leq x \quad \text{or} \quad x \geq 19$$

$$3. \quad -2(x-5)+6 > 4(3-x)$$

$$-2x+10+6 > 12-4x$$

$$-2x+16 > 12-4x$$

$$\begin{array}{r} +4x \quad \quad | +4x \\ \hline 2x+16 > | 12 \\ -16 \quad \quad | -16 \\ \hline 2x > | -4 \\ \frac{2x}{2} > | \frac{-4}{2} \\ x > -2 \end{array}$$

$$2. \quad \frac{2}{3}x-5 \geq 4x-6$$

$$3\left(\frac{2}{3}x-5\right) \geq 3(4x-6)$$

$$\begin{array}{r} 2x-15 \geq | 12x-18 \\ -2x \quad \quad | -2x \\ \hline -15 \geq | 10x-18 \\ +18 \quad \quad | +18 \\ \hline \frac{3}{10} \geq \frac{10x}{10} \end{array}$$

$$\frac{3}{10} \geq x \quad \text{OR} \quad x \leq \frac{3}{10}$$

Compound Inequalities

AND - When two inequalities are combined with the word "AND" it can be written in two ways. Option 1. $3 \leq 5x - 6 \leq 10$ Option 2. $3 \leq 5x - 6$ AND $5x - 6 \leq 10$

OR - When two inequalities are combined with the word "OR" it can only be written one way. $13 \leq 2x - 7$ OR $4x + 6 \geq 14$

Steps to follow...

1. Separate the compound inequalities into two individual inequalities.
2. Solve the individual inequalities.
3. Combine the two inequalities back together only if they are an AND statement.

Note: Always make sure that the inequality symbols point at the smaller outside numbers when you are finished combining an AND statement.

Solve each Compound Inequality.

4. $-7 \geq -4x + 5 \geq -19$

$$\begin{array}{rcl} -7 & \geq & -4x + 5 \\ -5 & & -5 \\ \hline -12 & \geq & -4x \\ -4 & & -4 \\ \hline 3 & \leq & x \end{array} \quad \text{and} \quad \begin{array}{rcl} -4x + 5 & \geq & -19 \\ -5 & & -5 \\ \hline -4x & \geq & -24 \\ -4 & & -4 \\ \hline x & \leq & 6 \end{array}$$

$$3 \leq x \leq 6$$

5. $5x - 8 < 7$ or $3x + 9 > 21$

$$\begin{array}{rcl} 5x - 8 & < & 7 \\ +8 & & +8 \\ \hline 5x & < & 15 \\ \frac{5x}{5} & < & \frac{15}{5} \\ x & < & 3 \end{array} \quad \text{or} \quad \begin{array}{rcl} 3x + 9 & > & 21 \\ -9 & & -9 \\ \hline 3x & > & 12 \\ \frac{3x}{3} & > & \frac{12}{3} \\ x & > & 4 \end{array}$$

$$x < 3 \quad \text{or} \quad x > 4$$

never combine an
"OR" statement