

Solve Linear Inequalities

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WHAT'S COVERED

In this lesson, you will learn how to solve a linear inequality. Specifically, this lesson will cover:

1. Solving Inequalities

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Solving inequalities is very similar to solving equations with one exception. If we multiply or divide by a negative number, the symbol will need to flip directions. We will keep that in mind as we solve inequalities.



HINT

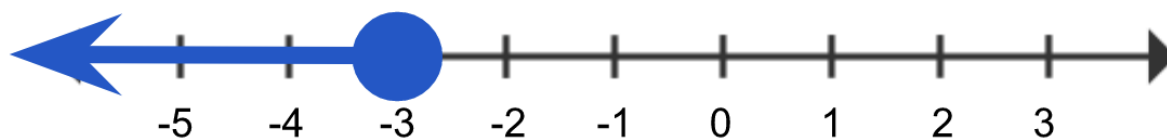
When multiplying or dividing by a negative number, the inequality sign switches. For example, greater than becomes less than, and less than becomes greater than.

⇒ **EXAMPLE** Solve the inequality $-2x \geq 6$, graph, and write in interval notation.

$$\frac{-2x}{-2} \geq \frac{6}{-2} \quad \text{Divide both sides by } -2$$

$$x \leq -3 \quad \text{Divide by a negative } - \text{ flip symbol!}$$

$$x \leq -3 \quad \text{Graph, starting at } -3, \text{ going down with a closed circle for less than or equal to}$$



$$(-\infty, -3] \quad \text{Interval Notation}$$

The inequality we solve can get as complex as the linear equations we solved. We will use all the same patterns to solve these inequalities as we did for solving equations. Just remember that any time we multiply or divide

by a negative the symbol switches directions (multiplying or dividing by a positive does not change the symbol!)

⇒ **EXAMPLE** Solve the inequality $3(2x - 4) + 4x < 4(3x - 7) + 8$, graph, and write in interval notation.

$$3(2x - 4) + 4x < 4(3x - 7) + 8 \quad \text{Distribute}$$

$$6x - 12 + 4x < 12x - 28 + 8 \quad \text{Combine like terms on both sides}$$

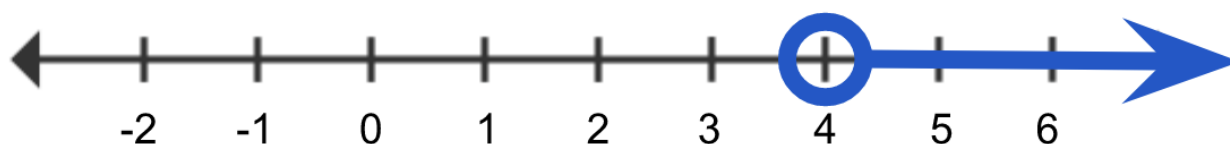
$$\begin{array}{r} 10x - 12 < 12x - 20 \\ -10x \quad -10x \\ \hline \end{array} \quad \text{Move } x \text{ to one side by subtracting } 10x \text{ from both sides}$$

$$\begin{array}{r} -12 < 2x - 20 \\ +20 \quad +20 \\ \hline \end{array} \quad \text{Add 20 to both sides}$$

$$\begin{array}{r} 8 < 2x \\ \frac{8}{2} < \frac{2x}{2} \end{array} \quad \text{Divide both sides by 2}$$

$$4 < x \quad \text{We can rewrite this with the } x \text{ on the other side.}$$

$$x > 4 \quad \text{Graph, starting at 4, going up with an open circle for less than or equal to}$$



$(4, \infty)$ Interval Notation



SUMMARY

When **graphing inequalities**, it is important to be careful when the inequality is written backwards as in the above example (4 less than x rather than x greater than 4). Often students draw their graphs the wrong way when this is the case. The inequality symbol opens to the variable, this means the variable is greater than 4. So we must shade above the 4.

Solving linear inequalities is similar to solving equations, except that we use an inequality symbol instead of an equal sign. When we're solving an inequality and you multiply or divide by a negative number, your inequality symbol is going to switch directions. Also, when we're solving a compound inequality, any operation done between the inequality symbols must be done on the other side of both inequality symbols.

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