

Module 7: Solving Linear Inequalities

Topic 2: Solving Algebraically

Introduction



Today's Lesson

- You will solve linear inequalities in two variables.
- You will use your ability to solve linear inequalities in one variable.
- Your knowledge of the properties of inequality will be useful.

Hello and welcome! I'm glad you could join me for this lesson in Algebra I. In this lesson, we will focus on solving linear inequalities in two variables. Your knowledge of how to solve linear inequalities in one variable and the properties of inequality will help you successfully progress through this lesson. So without any further ado, let's begin!

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Anticipatory Set

Solve for x .

$$5(x + 2) - 4x < 2$$

Step 1: Are there any parentheses?

This inequality does have parentheses, so you will need to use the distributive property to expand the left side.

$$5(x + 2) - 4x < 2$$

Use the distributive property to eliminate the parentheses.

$$5x + 10 - 4x < 2$$

Step 2: Are there any like terms to combine?

In this case, you do have like terms to combine. Remember to only combine like terms that are on the same side of the inequality.

$$5x + 10 - 4x < 2$$

$5x$ minus $4x$ is $1x$. Remember that you do not need to write the 1.

$$x + 10 < 2$$

Step 3: Now, use inverse operations to isolate the variable.

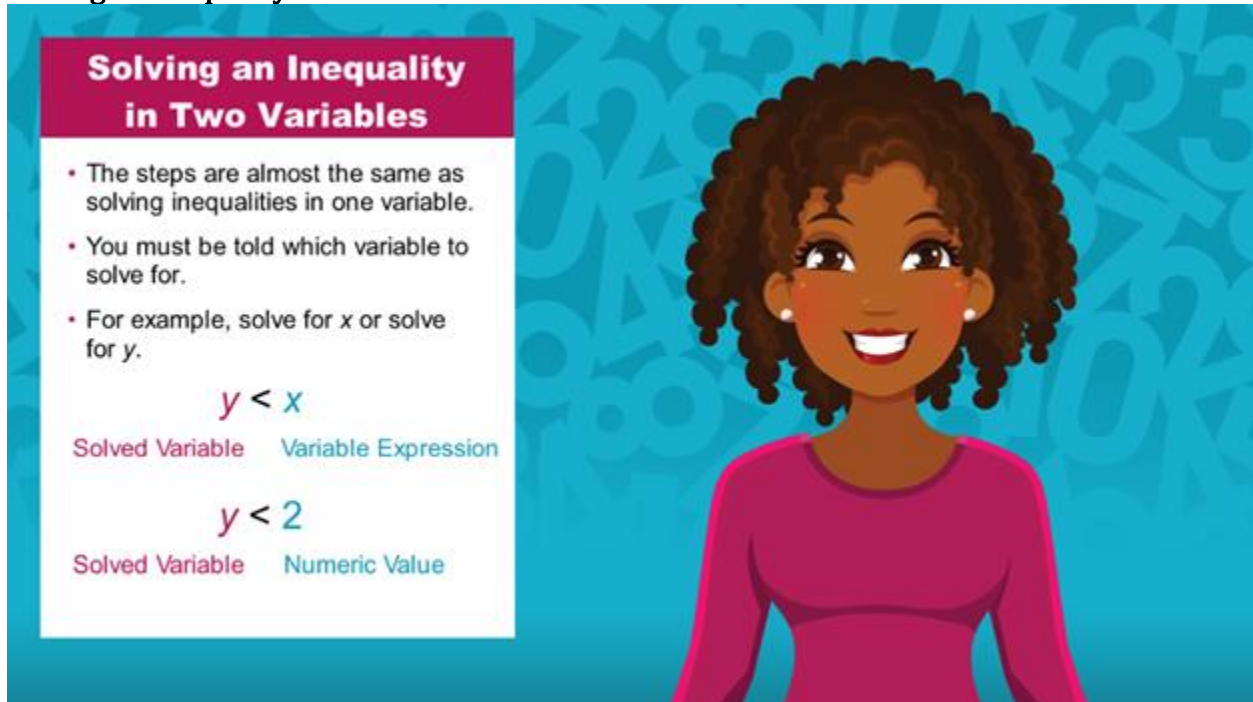
$$\begin{array}{r} x + 10 < 2 \\ - 10 \quad - 10 \\ \hline x < -8 \end{array}$$

Recall that the subtraction property of inequality states that you can subtract the same value from each side of an inequality and the inequality will remain true. So subtract 10 from each side of the inequality.

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Solving an Inequality in Two Variables



Solving an Inequality in Two Variables

- The steps are almost the same as solving inequalities in one variable.
- You must be told which variable to solve for.
- For example, solve for x or solve for y .

$y < x$
Solved Variable Variable Expression

$y < 2$
Solved Variable Numeric Value

You have performed this process numerous times in order to solve inequalities that only included one variable. You will perform a similar process in order to solve inequalities that include two variables. When solving an inequality in two variables, however, you must be instructed as to which variable to solve for.

The next few examples will involve inequalities that include the variables x and y , and you will be solving for y each time. The goal in this situation, generally, is to end with y on the left side of the inequality, and an expression on the right side. Sometimes that expression will be numeric. Often, however, it will be a variable expression.

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Solving Algebraically

**SOLVING MULTI-STEP LINEAR INEQUALITIES
IN TWO VARIABLES ALGEBRAICALLY**

Click the Examples Below to Learn More

Example One

Example Three

Example Two

Self-Check

Click the examples below to learn more.

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Example 1

Solve for y .

$$5(-6x + y) \geq 20$$

Step 1: Are there any *parentheses*?

This inequality does have parentheses, so you will need to use the distributive property to simplify the left side.

$$5(-6x + y) \geq 20$$

Use the distributive property to eliminate the parentheses.

$$-30x + 5y \geq 20$$

Step 2: Do you have any *like terms to combine*?

In this case, you do not have any like terms to combine. So, you can move on to Step 3.

Step 3: Now, it's time to *isolate the variable*.

In this example, you are asked to solve for y . Begin using inverse operations to isolate y .

$$-30x + 5y \geq 20$$

$$\begin{array}{r} +30x \qquad \qquad +30x \\ \hline \end{array}$$

Add $30x$ to both sides of the inequality.

$$5y \geq 30x + 20$$

$$\begin{array}{r} \hline \frac{5y}{5} \geq \frac{30x}{5} + \frac{20}{5} \end{array}$$

Now divide each term by 5.

$$y \geq 6x + 4$$

The final result is y is greater than or equal to $6x$ plus 4.

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Example 2

Solve for y .

$$-3y - 15 > 2x - 3$$

Step 1: Are there any *parentheses*?

This inequality does not have any parentheses, so we will not need to use the distributive property. So, move on to Step 2.

Step 2: Do you have any *like terms to combine*?

In this case, we have no like terms to combine. So, move on to Step 3.

Step 3: Now, it's time to *isolate the variable*.

In this example, you are asked to solve for y . Begin using inverse operations to isolate y .

$$-3y - 15 > 2x - 3$$

$$\begin{array}{r} +15 \qquad +15 \\ \hline -3y > 2x + 12 \end{array}$$

Add 15 to both sides of the inequality.

$$\begin{array}{r} -3y > 2x + 12 \\ \hline -3 \quad -3 \quad -3 \end{array}$$

Now divide each term by negative three.

$$y < -\frac{2}{3}x - 4$$

Remember, because you are dividing both sides of the inequality by a negative number, you must flip the inequality sign.

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Example 3

Solve for y .

$$7y - 3(x + 2y) > 4$$

Step 1: Are there any *parentheses*?

This inequality does have parentheses, so you will need to use the distributive property to simplify the left side.

$$7y - 3(x + 2y) > 4$$

Apply the distributive property to eliminate the parentheses.

$$7y - 3x - 6y > 4$$

Step 2: Do you have any *like terms to combine*?

In this case, you do have some like terms to combine.

$$7y - 3x - 6y > 4$$

On the left side of the inequality, you can combine $7y$ and negative $6y$. There are no like terms to combine on the right side of the inequality, so you can move on to Step 3.

$$y - 3x > 4$$

Step 3: Now, it's time to *isolate the variable*.

In this example, you are asked to solve for y . Begin using inverse operations to isolate y .

$$y - 3x > 4$$

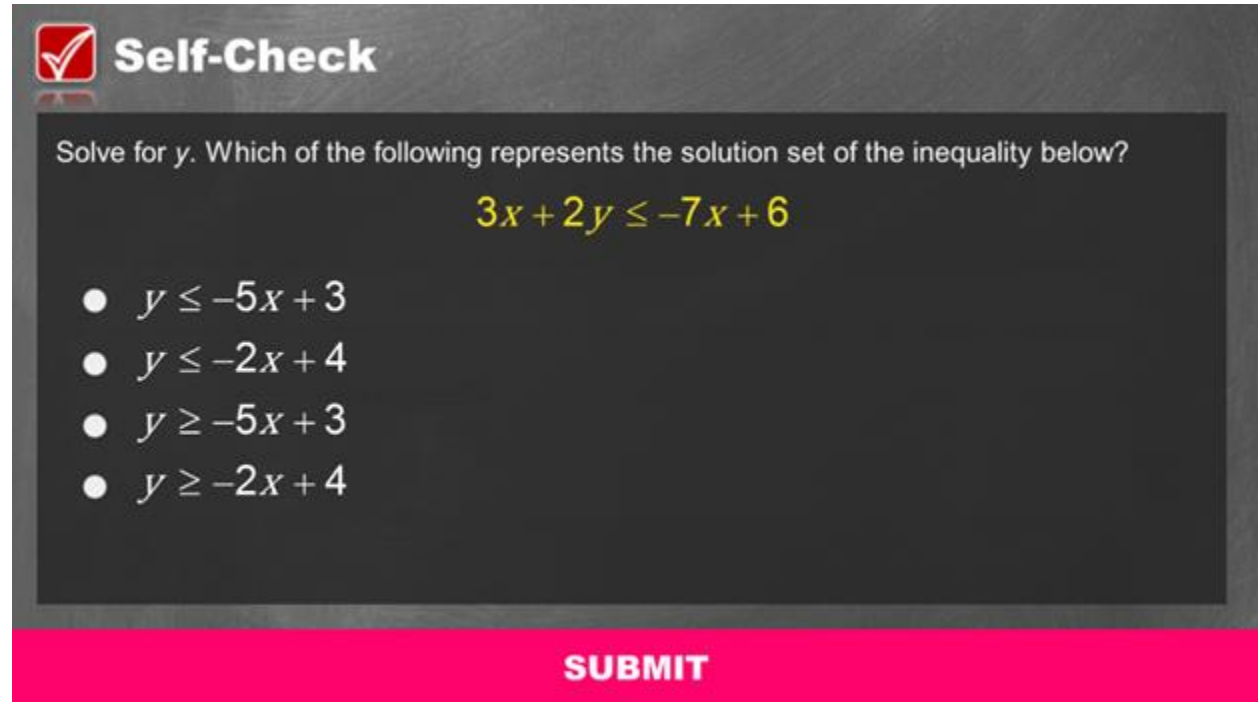
$$\begin{array}{r} +3x \quad +3x \\ \hline \end{array}$$

Add $3x$ to both sides.

$$y > 3x + 4$$

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Self-Check 1

A digital interface for a self-check exercise. It features a dark grey background with a red checkmark icon and the text "Self-Check" in white. Below this, a question asks to solve for y and identify the solution set for a given inequality. The inequality is displayed in yellow. Four multiple-choice options are listed in white. At the bottom, there is a prominent pink button labeled "SUBMIT".

Self-Check

Solve for y . Which of the following represents the solution set of the inequality below?

$$3x + 2y \leq -7x + 6$$

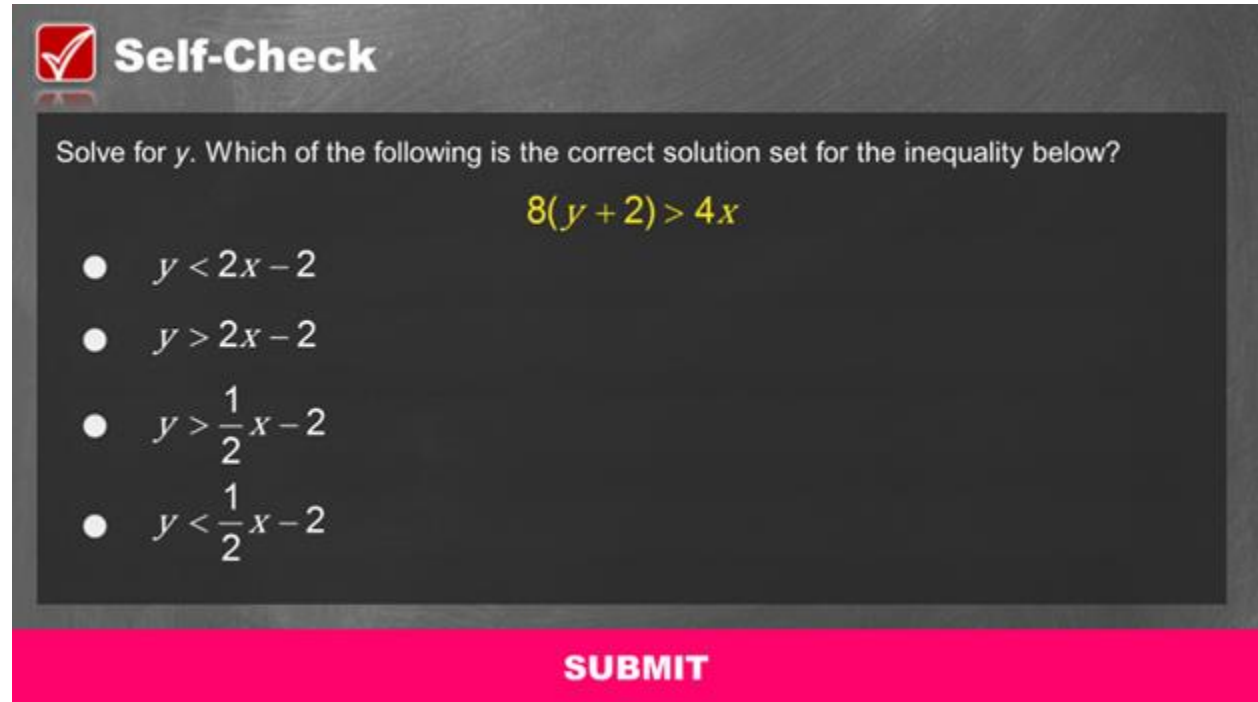
- $y \leq -5x + 3$
- $y \leq -2x + 4$
- $y \geq -5x + 3$
- $y \geq -2x + 4$

SUBMIT

Solve the problem in the image above to check your understanding of the content.

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Self-Check 2



Self-Check

Solve for y . Which of the following is the correct solution set for the inequality below?

$$8(y + 2) > 4x$$

- $y < 2x - 2$
- $y > 2x - 2$
- $y > \frac{1}{2}x - 2$
- $y < \frac{1}{2}x - 2$

SUBMIT

Solve the problem in the image above to check your understanding of the content.

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Self-Check 2: Answer

S

Correct

That's correct! Begin by using the distributive property to expand the left side of the inequality.

$$8(y + 2) > 4x$$
$$8y + 16 > 4x$$

Now it's time to use inverse operations to isolate y . Subtract 16 from both sides.

$$\begin{array}{r} 8y + 16 > 4x \\ -16 \quad -16 \\ \hline 8y > 4x - 16 \end{array}$$

Now divide each term by 8.

$$\begin{array}{r} 8y > 4x - 16 \\ \hline 8 \quad 8 \quad 8 \\ y > \frac{4}{8}x - 2 \end{array}$$

Be sure to reduce the fraction.

$$y > \frac{4}{8}x - 2$$
$$y > \frac{1}{2}x - 2$$

Continue

SUBMIT

For your reference, the image above shows the correct solution to the self-check problem.

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Conclusion



The image shows a digital interface for a lesson conclusion. On the left, a white box with a pink header titled "Today's Lesson" contains a checklist of three items, each with a checkmark: "Solved linear inequalities in two variables algebraically", "Used knowledge of solving linear inequalities in one variable", and "Used knowledge of the properties of inequality". Below the list are two pink buttons: "Exit Lesson" and "Restart Lesson". To the right of the box is a cartoon illustration of a woman with dark curly hair, wearing a pink top, set against a blue background with faint mathematical symbols like pi, infinity, and numbers.

You have reached the conclusion of your lesson in solving linear inequalities in two variables. During this lesson, you used your prior knowledge of solving linear inequalities in one variable, as well as your knowledge of the properties of inequality in order to successfully progress through this lesson. I'll see you again soon! Bye for now.