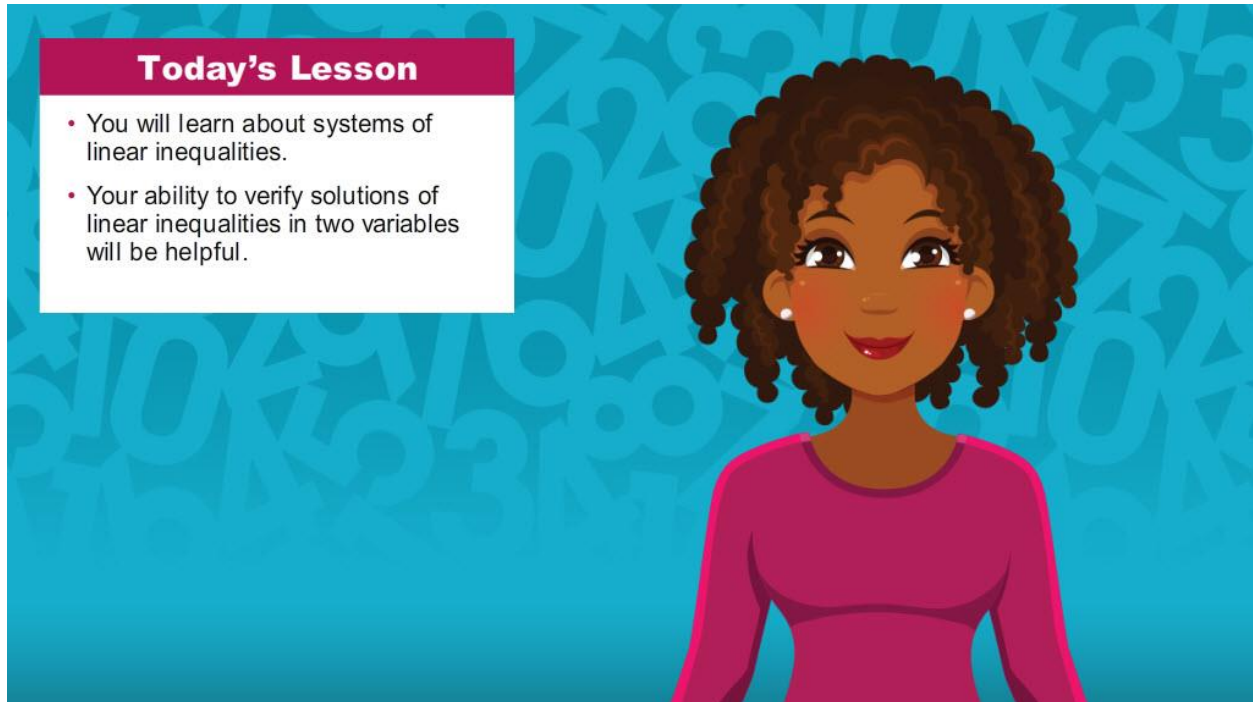


Module 7: Solving Linear Inequalities

Topic 3: Systems of Inequalities

Introduction



Today's Lesson

- You will learn about systems of linear inequalities.
- Your ability to verify solutions of linear inequalities in two variables will be helpful.

Hello and welcome! I'm so glad to have you here for this lesson in Algebra I. In this lesson, you will learn about systems of linear inequalities. Your knowledge of how to verify solutions of linear inequalities in two variables, both algebraically and graphically, will help you successfully progress through this lesson. Let's get started!

Module 7: Solving Linear Inequalities

Topic 3: Systems of Inequalities

Systems of Inequalities

SYSTEMS OF INEQUALITIES

Click the Examples Below to Learn More

Example One

Self-Check

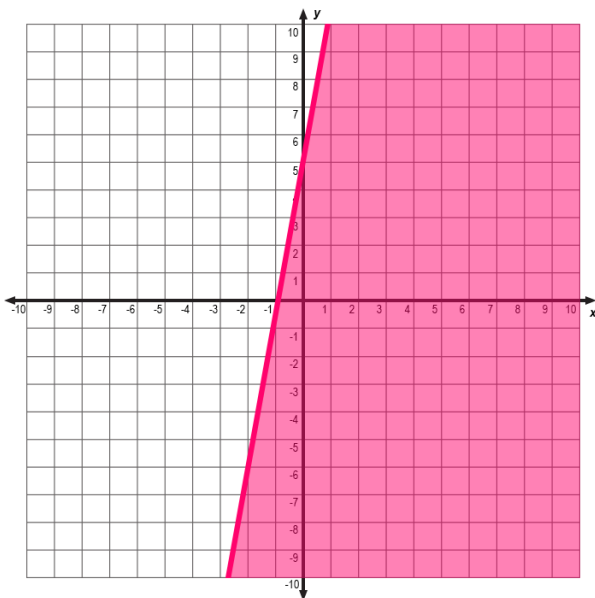
Click the examples below to learn more.

Module 7: Solving Linear Inequalities

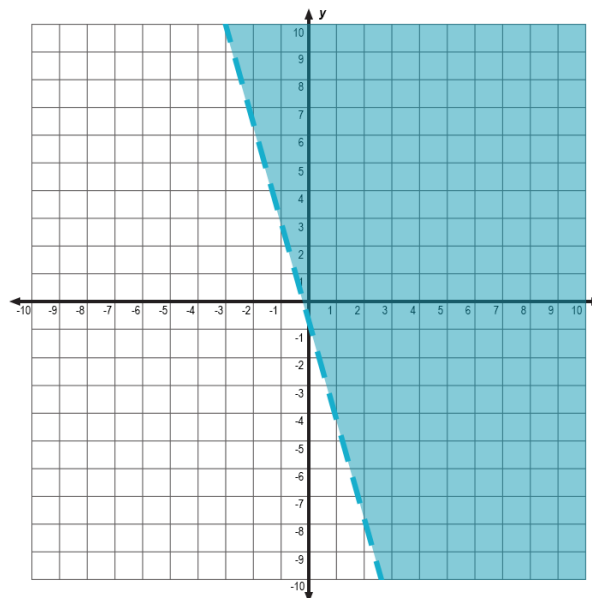
Topic 3: Systems of Inequalities

Example 1

You have had practice working with the graphs of linear inequalities. Take, for example, the inequalities in the warm-up:



$$y - 6x \leq 5$$



$$y > -4x - 1$$

In the linear inequality, $y - 6x \leq 5$, you know that solutions can be found along the solid line and in the shaded area.

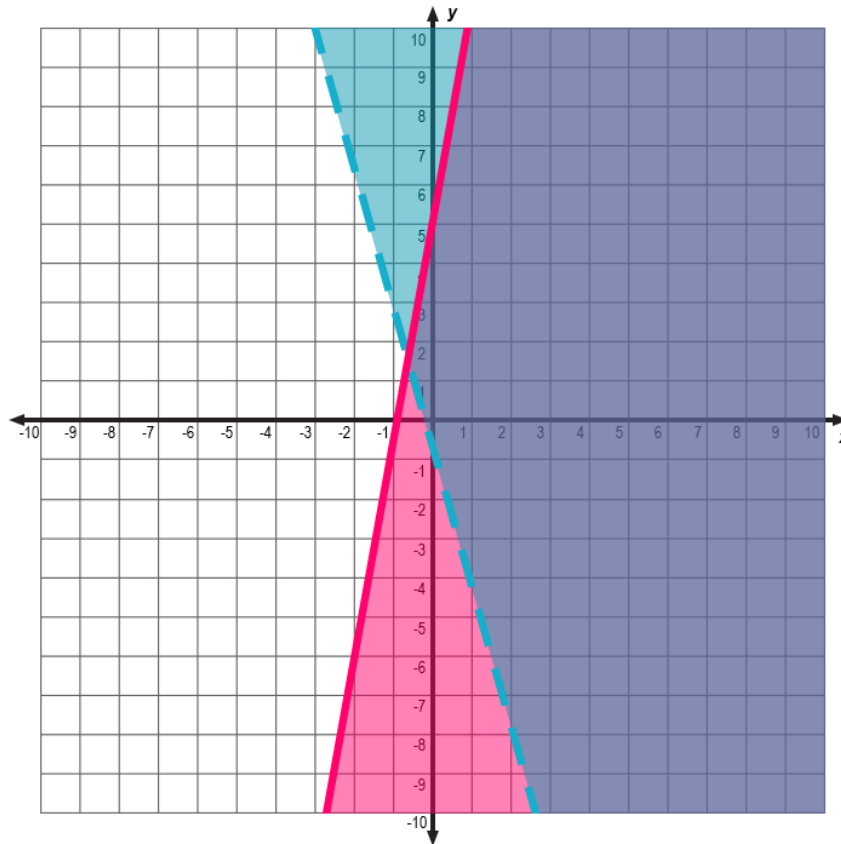
In the linear inequality, $y > -4x - 1$, you know that solutions can only be found in the shaded area, because points along the dashed line are not included in the solution set.

Take a look at what happens when you consider these two inequalities together, as a group.

Module 7: Solving Linear Inequalities

Topic 3: Systems of Inequalities

Example 1 (continued)



$$\begin{cases} y - 6x \leq 5 \\ y > -4x - 1 \end{cases}$$

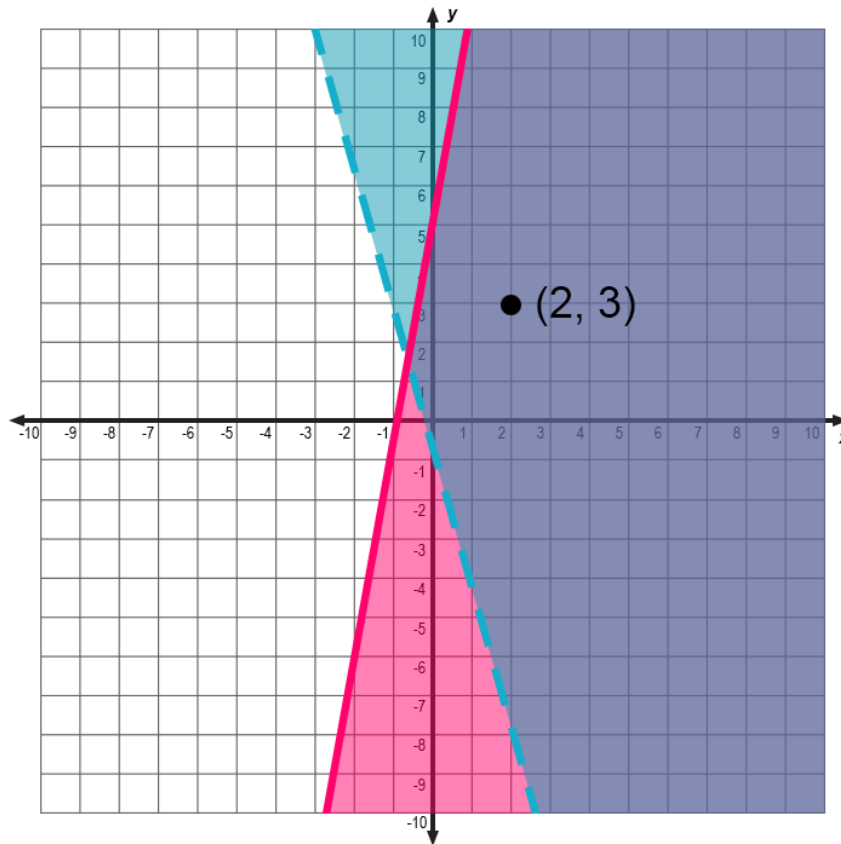
A group of linear inequalities, written in the same variables, is known as a system of linear inequalities. The solution to a system has two characteristics:

1. Graphically, solutions are included in the overlap of the shaded areas of the inequalities and at the intersection of two solid lines
2. Algebraically, any ordered pair that is a solution to each individual inequality, is a solution to the system of linear inequalities.

Module 7: Solving Linear Inequalities

Topic 3: Systems of Inequalities

Example 1 (continued)



This system includes one dashed line and one solid line. Therefore, no solutions to the system will be found at the intersection. For this system, solutions will only include those points located within the overlap of the shaded areas.

Take, for example, the point $(2, 3)$. $(2, 3)$ is included in the overlap of the shaded areas of the linear inequalities. This means that $(2, 3)$ is a solution to the system of linear inequalities.

Module 7: Solving Linear Inequalities

Topic 3: Systems of Inequalities

Example 1 (continued)

You can also verify this solution algebraically. In each inequality, substitute 2 for x and 3 for y . If each inequality holds true, then you have verified that $(2, 3)$ is a solution to the system.

$$y - 6x \leq 5$$

$$\begin{matrix} (2, 3) \\ x \quad y \end{matrix}$$

$$y - 6x \leq 5$$

$$3 - 6(2) \leq 5$$

$$3 - 12 \leq 5$$

$$-9 \leq 5$$

In the first inequality, is 3 minus the product of 6 and 2 less than or equal to 5?

-9 is less than or equal to 5. So, the inequality held true. $(2, 3)$ is a solution to $y - 6x \leq 5$.

$$y > -4x - 1$$

$$\begin{matrix} (2, 3) \\ x \quad y \end{matrix}$$

$$y > -4x - 1$$

$$3 > -4(2) - 1$$

$$3 > -8 - 1$$

$$3 > -9$$

In the second inequality, is 3 greater than -4 times 2 minus 1?


3 is greater than -9 . So, the inequality held true. $(2, 3)$ is a solution to $y > -4x - 1$.

Because $(2, 3)$ is a solution of each inequality, it is a solution to the system of inequalities.

Module 7: Solving Linear Inequalities

Topic 3: Systems of Inequalities

Self-Check 1

 **Self-Check**

For this question, continue to work with the system below.

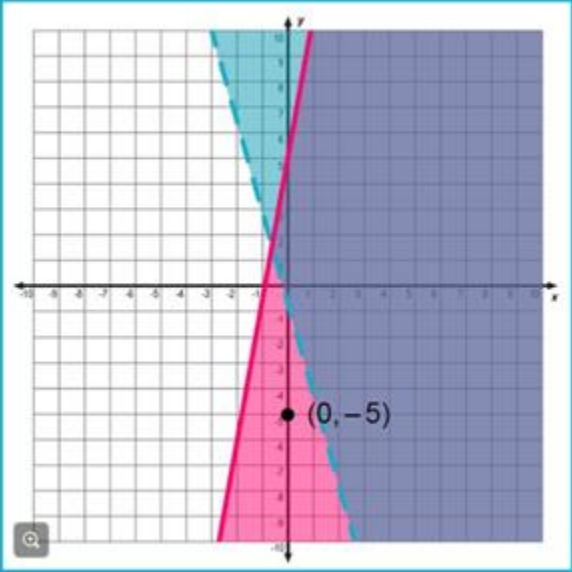
$$\begin{cases} y - 6x \leq 5 \\ y > -4x - 1 \end{cases}$$

Consider the point $(0, -5)$. Where is this point included?

- In the overlap of the shaded areas
- In the shaded area of only one of the linear inequalities
- In the unshaded area

SUBMIT

Graph



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

Module 7: Solving Linear Inequalities

Topic 3: Systems of Inequalities

Self-Check 1: Answer


The screenshot shows a digital interface for a self-check. At the top left, there is a red checkmark icon and the text "Self Check". At the top right, the word "Graph" is displayed in white on a blue background. The main content area is a light gray box with the word "Correct" in bold black text at the top left. Below this, there is a coordinate plane graph with a grid. Two lines are plotted: a blue line with a positive slope and a pink line with a negative slope. The region between these two lines is shaded in a darker blue. A point is marked on the pink line at the coordinates (0, -5). To the right of the graph, a text message reads: "That's correct! The point (0, -5) is included in the shaded area of only one of the linear inequalities." Below the graph and text is a "Continue" button. At the bottom of the interface, there is a red bar with the word "SUBMIT" in white capital letters.

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

Module 7: Solving Linear Inequalities

Topic 3: Systems of Inequalities

Self-Check 2

 **Self-Check**

For this question, continue to work with the system below.

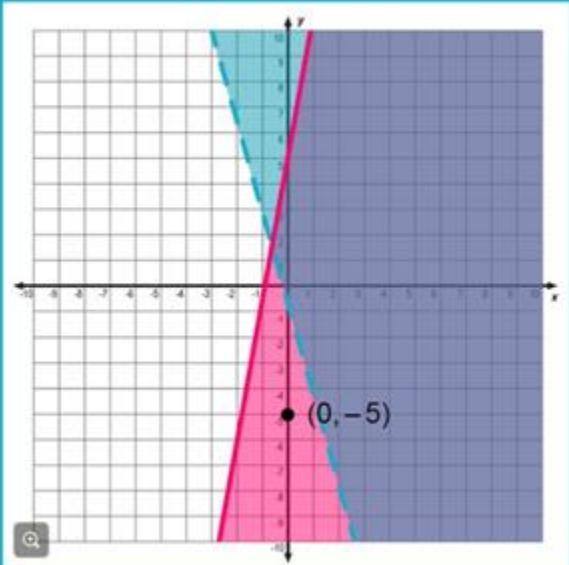
$$\begin{cases} y - 6x \leq 5 \\ y > -4x - 1 \end{cases}$$

Consider the point $(0, -5)$. Based on the graph, the point $(0, -5)$ is...

- a solution to the system of linear inequalities.
- not a solution to the system of linear inequalities.

SUBMIT

Graph



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

Module 7: Solving Linear Inequalities

Topic 3: Systems of Inequalities

Self-Check 2: Answer

Correct

That's correct! The point $(0, -5)$ is not included in the overlap of the shaded areas of the linear inequalities. Therefore, it is not included in the solution set of the system of linear inequalities.

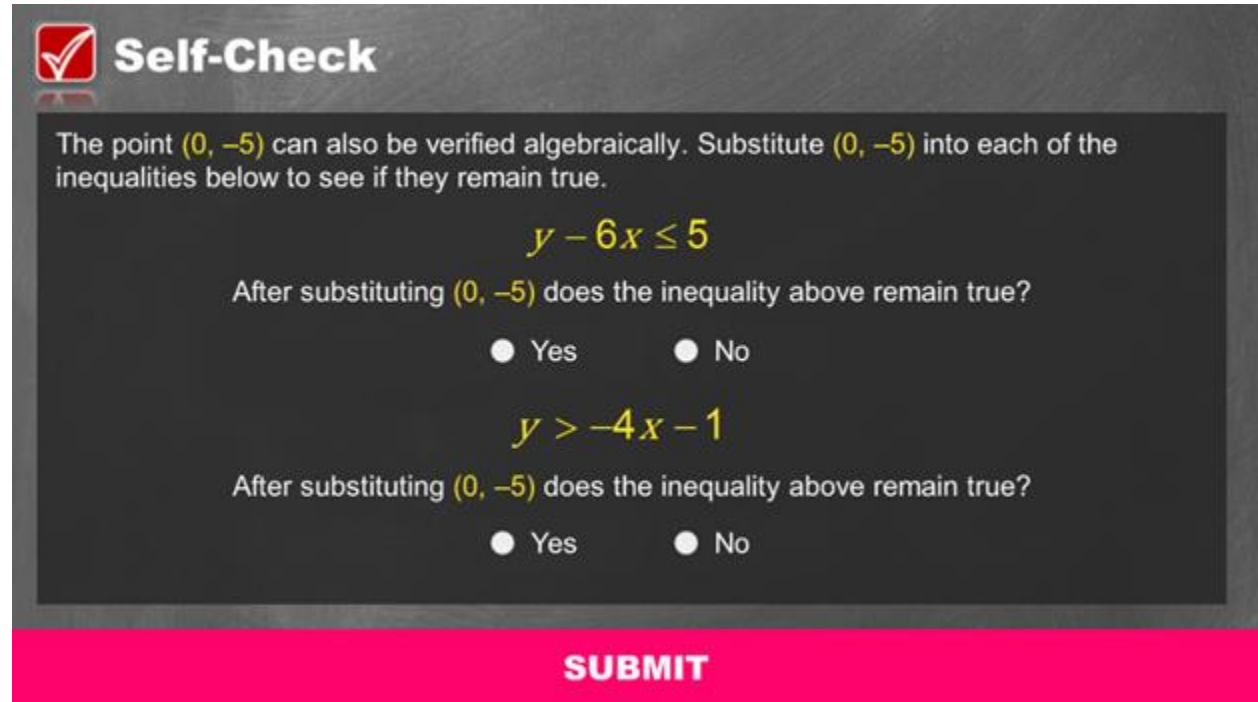
Continue

SUBMIT

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

Module 7: Solving Linear Inequalities
Topic 3: Systems of Inequalities

Self-Check 3

The image shows a digital interface for a self-check exercise. At the top left, there is a red checkmark icon followed by the text "Self-Check". Below this, a dark grey box contains the following text: "The point (0, -5) can also be verified algebraically. Substitute (0, -5) into each of the inequalities below to see if they remain true." The first inequality is $y - 6x \leq 5$. Below it, the text asks "After substituting (0, -5) does the inequality above remain true?" with two radio button options: "Yes" and "No". The second inequality is $y > -4x - 1$. Below it, the text asks "After substituting (0, -5) does the inequality above remain true?" with two radio button options: "Yes" and "No". At the bottom of the interface is a bright pink button with the word "SUBMIT" in white capital letters.

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

Module 7: Solving Linear Inequalities

Topic 3: Systems of Inequalities

Self-Check 3: Answer

Correct

$$\begin{cases} y - 6x \leq 5 \\ y > -4x - 1 \end{cases}$$

$(0, -5)$

$$\begin{array}{r} y - 6x \leq 5 \\ -5 - 6(0) \leq 5 \\ -5 - 0 \leq 5 \\ -5 \leq 5 \end{array}$$

The inequality holds true, therefore $(0, -5)$ is a solution to $y - 6x \leq 5$.

$(0, -5)$

$$\begin{array}{r} y > -4x - 1 \\ -5 > -4(0) - 1 \\ -5 > 0 - 1 \\ -5 \not> -1 \end{array}$$

The inequality does not hold true, therefore $(0, -5)$ is not a solution to $y > -4x - 1$.

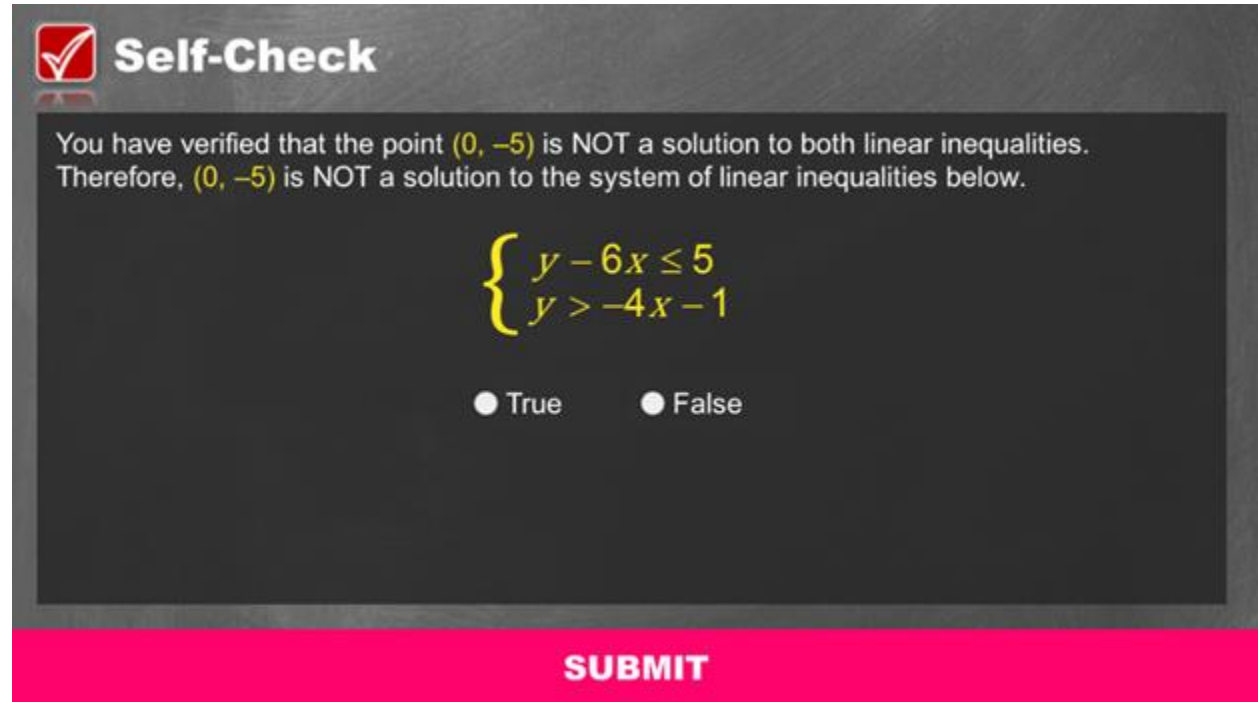
Continue

SUBMIT

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

Module 7: Solving Linear Inequalities
Topic 3: Systems of Inequalities

Self-Check 4

A self-check interface with a dark grey background. At the top left is a red checkmark icon followed by the text "Self-Check". Below this, a text box contains the message: "You have verified that the point (0, -5) is NOT a solution to both linear inequalities. Therefore, (0, -5) is NOT a solution to the system of linear inequalities below." In the center, a system of linear inequalities is displayed in yellow:
$$\begin{cases} y - 6x \leq 5 \\ y > -4x - 1 \end{cases}$$
 Below the equations are two radio button options: "True" and "False". At the bottom of the interface is a bright pink bar with the word "SUBMIT" in white capital letters.

Self-Check

You have verified that the point $(0, -5)$ is NOT a solution to both linear inequalities. Therefore, $(0, -5)$ is NOT a solution to the system of linear inequalities below.

$$\begin{cases} y - 6x \leq 5 \\ y > -4x - 1 \end{cases}$$

True False

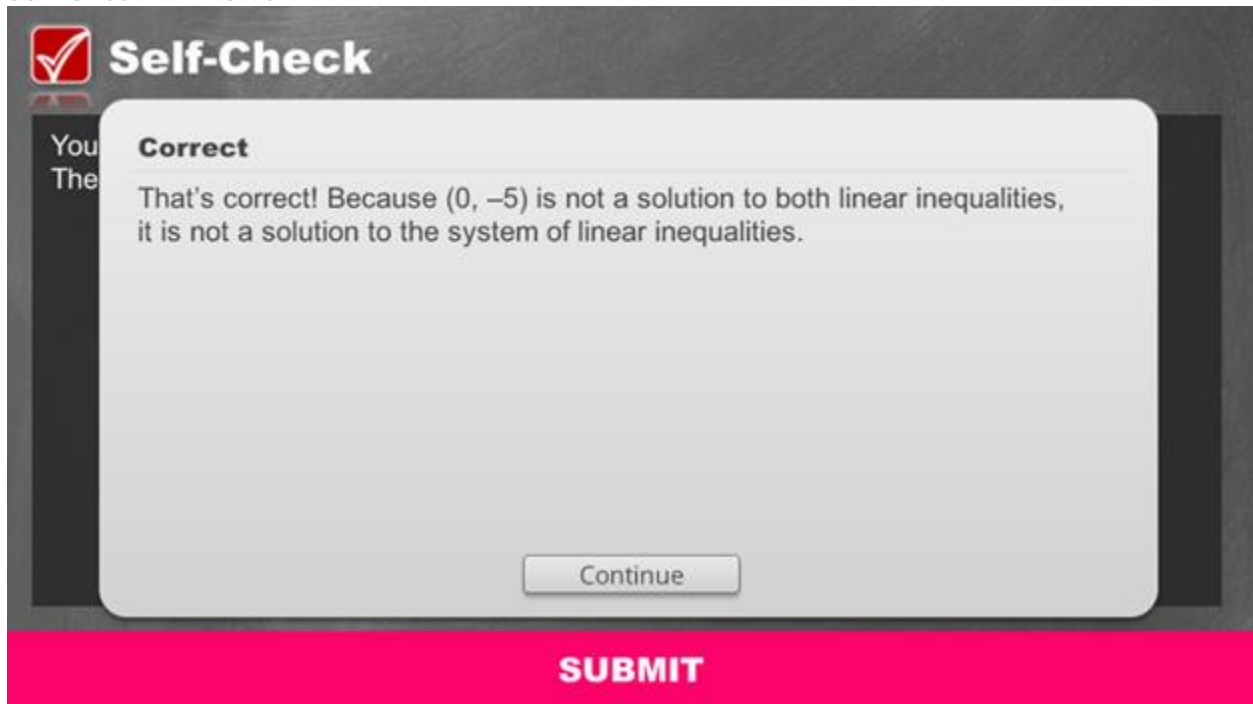
SUBMIT

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

Module 7: Solving Linear Inequalities

Topic 3: Systems of Inequalities

Self-Check 4: Answer



The image shows a digital interface for a self-check. At the top left, there is a red checkmark icon and the text "Self-Check". Below this, on the left side, the text "You" and "The" is partially visible. The main content area is a light gray rounded rectangle with the word "Correct" in bold. Below "Correct" is the text: "That's correct! Because $(0, -5)$ is not a solution to both linear inequalities, it is not a solution to the system of linear inequalities." At the bottom center of this gray area is a button labeled "Continue". Below the gray area is a bright pink horizontal bar with the word "SUBMIT" in white capital letters.

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

Module 7: Solving Linear Inequalities

Topic 3: Systems of Inequalities

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 two bullet points, each with a checkmark: "Determined solutions to a system of inequalities graphically" and "Determined solutions to a system of inequalities algebraically". Below these are two pink buttons: "Exit Lesson" and "Restart Lesson". To the right of the box is a cartoon illustration of a young woman with dark curly hair, wearing a pink long-sleeved shirt, set against a blue background with faint mathematical symbols like pi, infinity, and numbers.

Congratulations! You have reached the conclusion of your lesson on systems of linear inequalities. You are now well-equipped with the skills necessary to determine a solution to a system of inequalities, both graphically and algebraically.