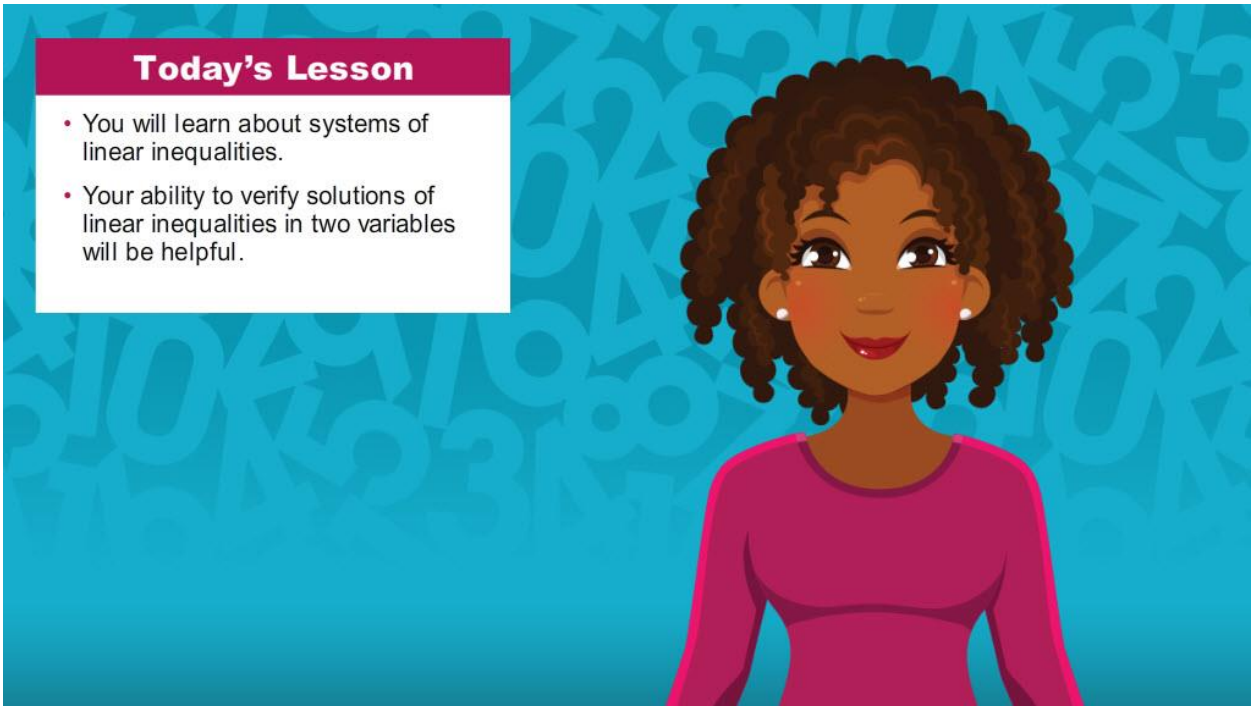
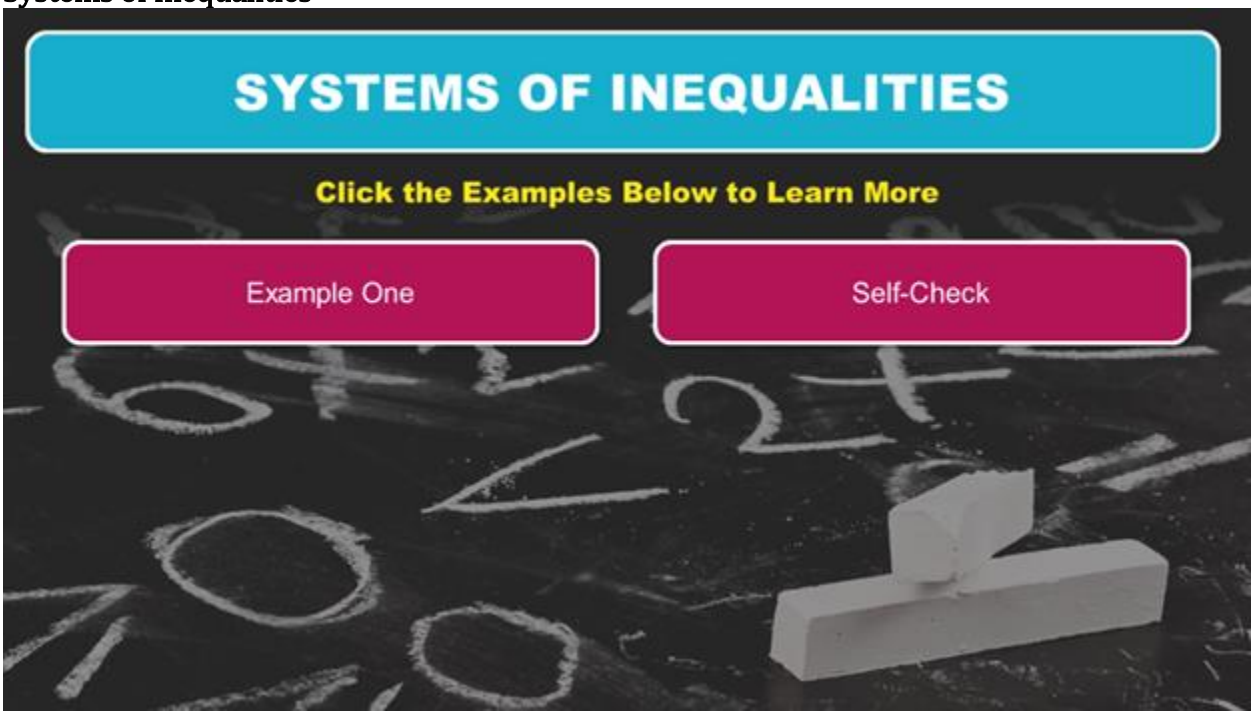
Module 7: Solving Linear Inequalities
Topic 3: Systems of Inequalities

Introduction



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!

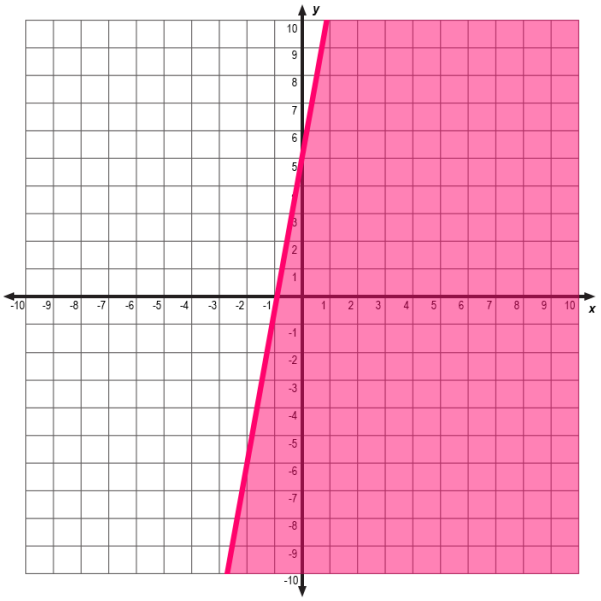
Systems of Inequalities



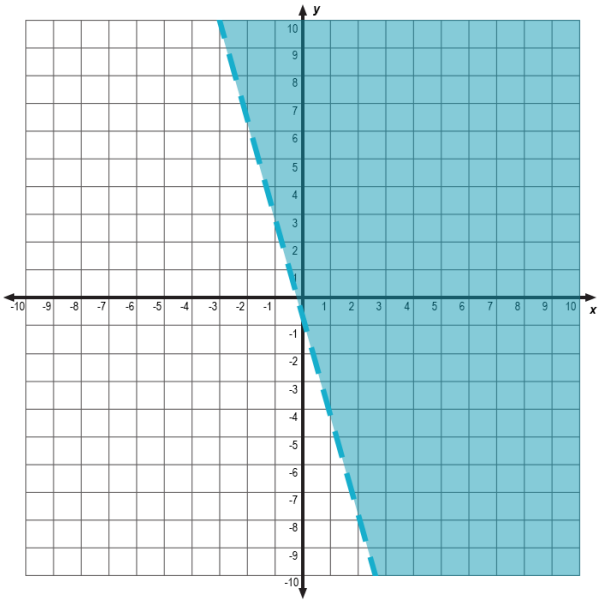
Click the examples below to learn more.

Example 1

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



$y - 6x \leq 5$



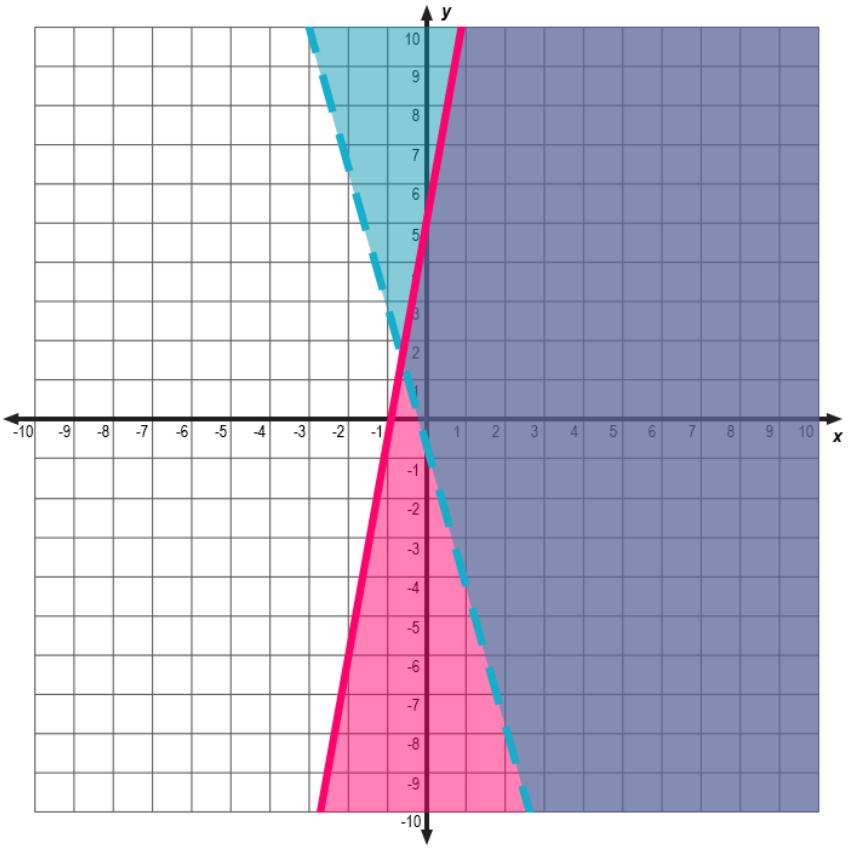
$y > -4x - 1$

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.

Example 1 (continued)



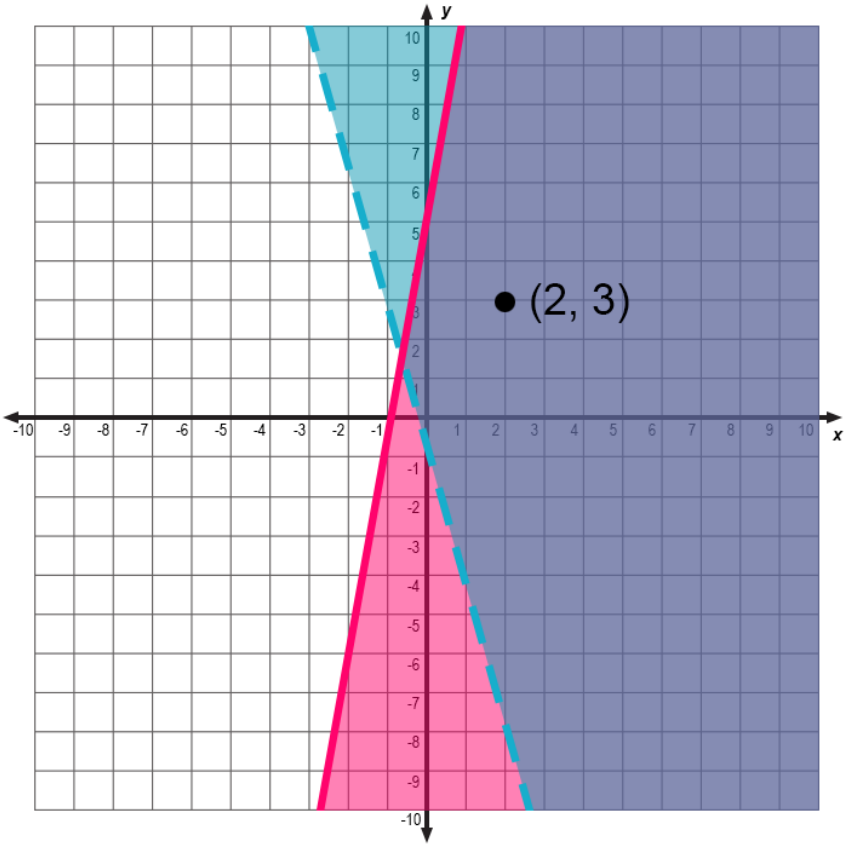
$$\begin{cases} y - 6x \leq 5 \\ y > -4x - 1 \end{cases}$$

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.

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.

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.

$y - 6x \leq 5$

(2, 3)
x y

$y - 6x \leq 5$	In the first inequality, is 3 minus the product of 6 and 2 less than or equal to 5?
$3 - 6(2) \quad 5$	
$3 - 12 \quad 5$	
$-9 \leq 5$	-9 is less than or equal to 5. So, the inequality held true. $(2, 3)$ is a solution to $y - 6x \leq 5$.

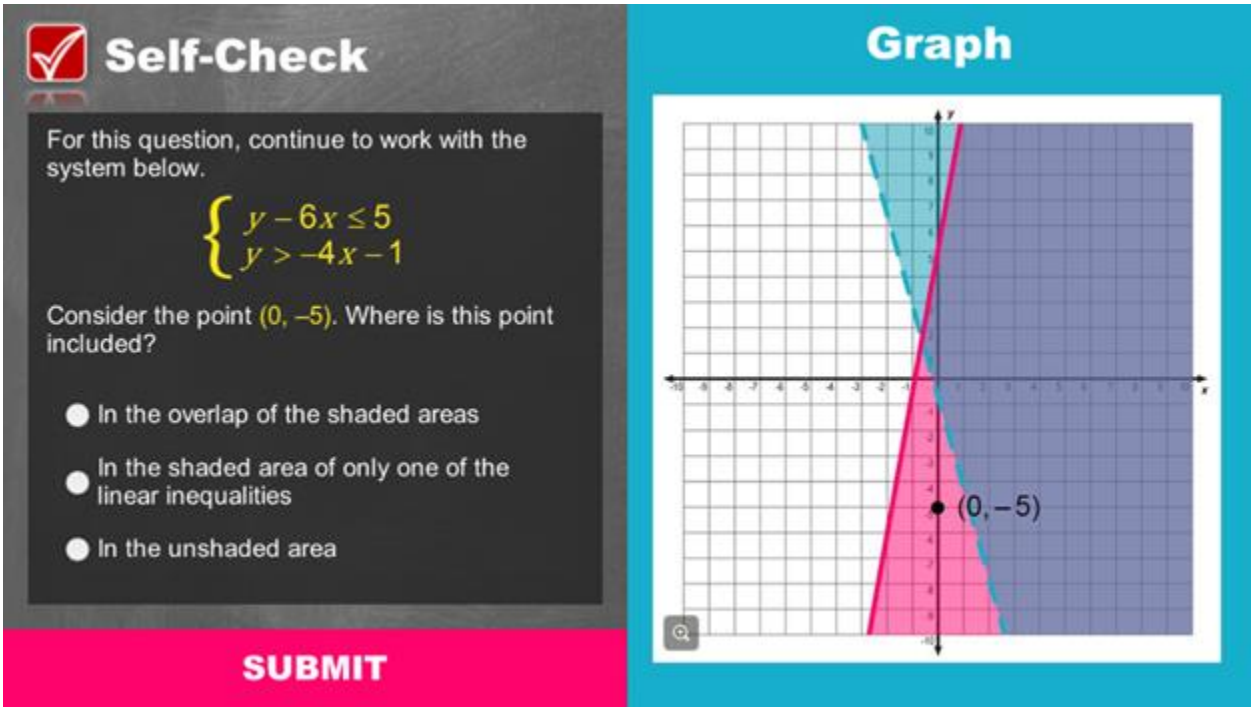
$y > -4x - 1$

(2, 3)
x y

$y > -4x - 1$	In the second inequality, is 3 greater than –4 times 2 minus 1?
$3 \quad -4(2) - 1$	
$3 \quad -8 - 1$	
$3 > -9$	3 is greater than –9. So, the inequality held true. $(2, 3)$ is a solution to $y > -4x - 1$.

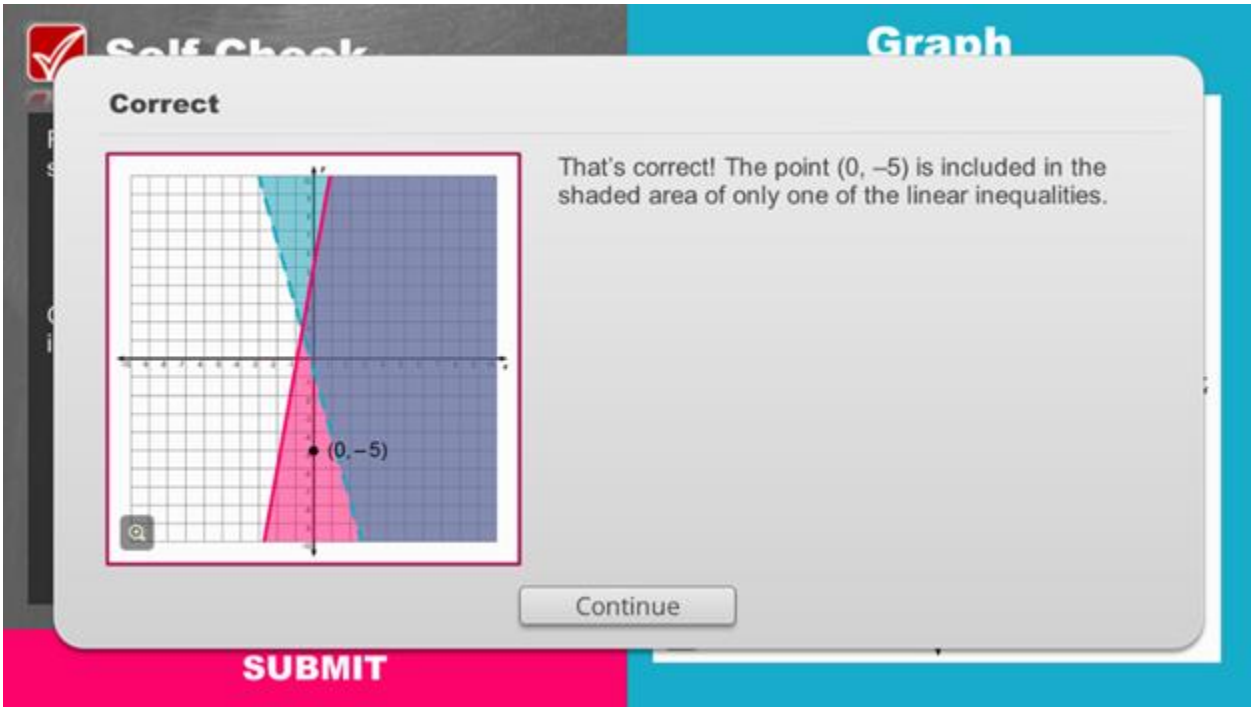
Because $(2, 3)$ is a solution of each inequality, it is a solution to the system of inequalities.

Self-Check 1



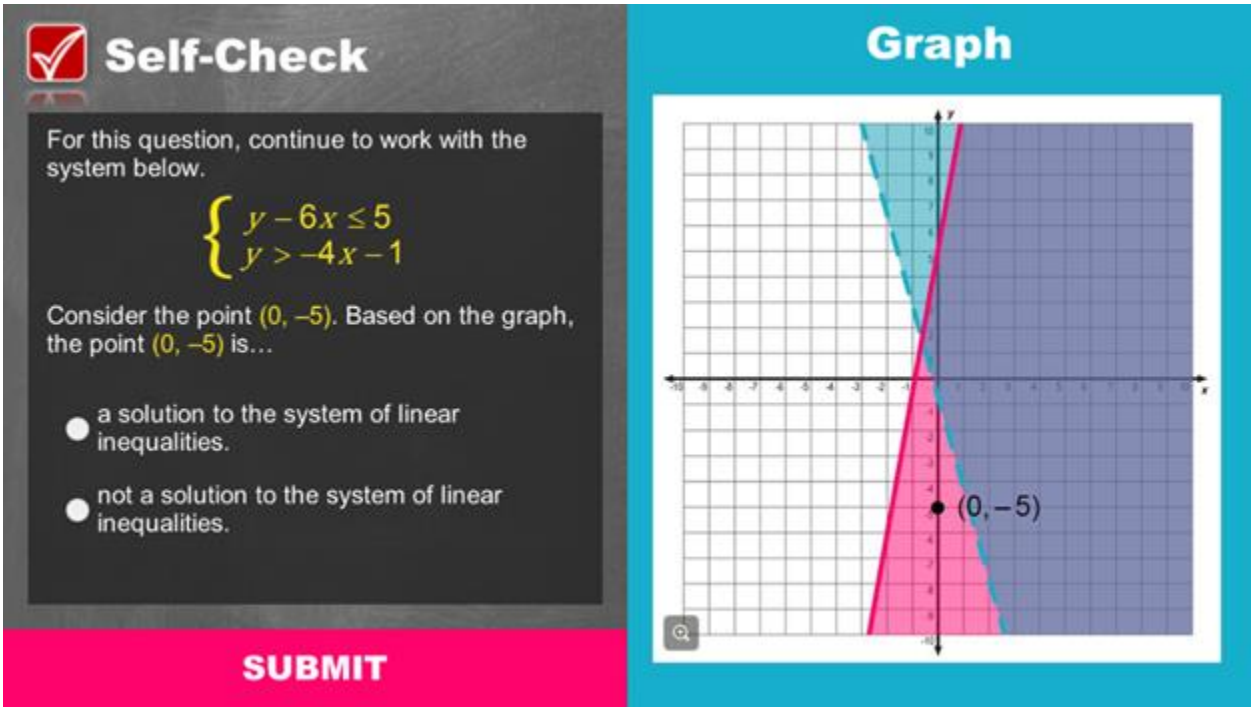
Solve the problem in the image above to check your understanding of the content.

Self-Check 1: Answer



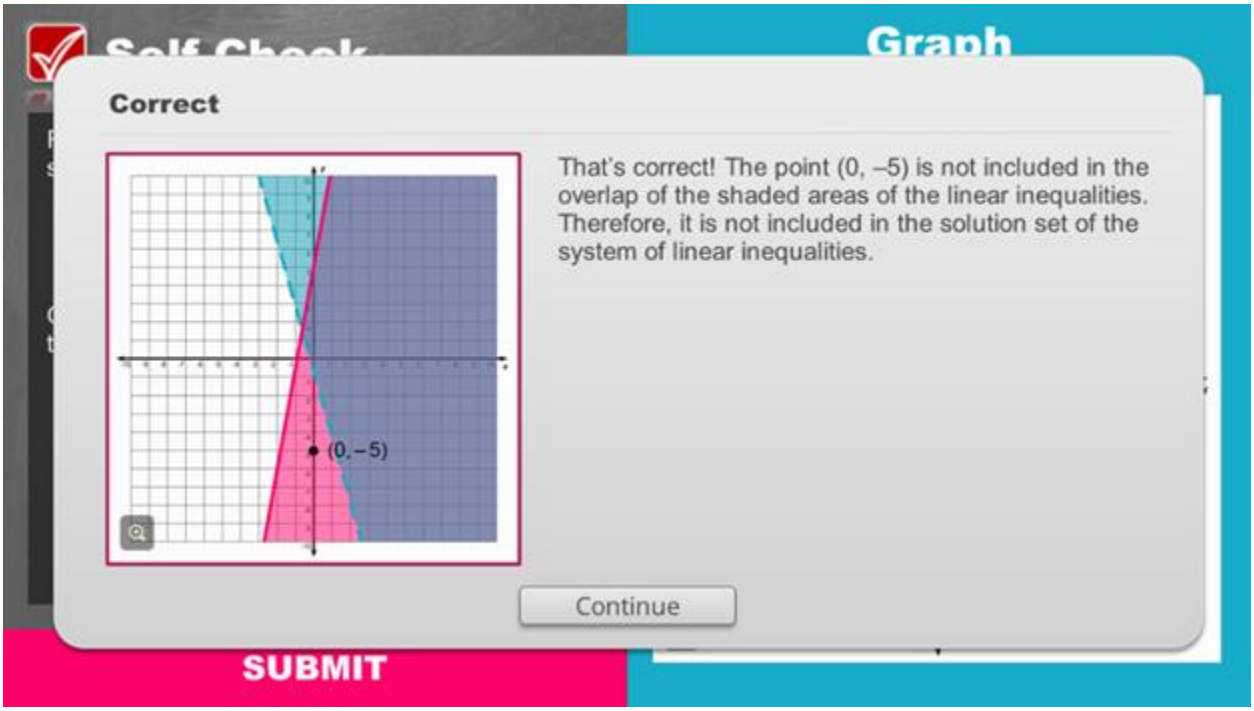
For your reference, the image above shows the correct solution to the self-check problem.

Self-Check 2



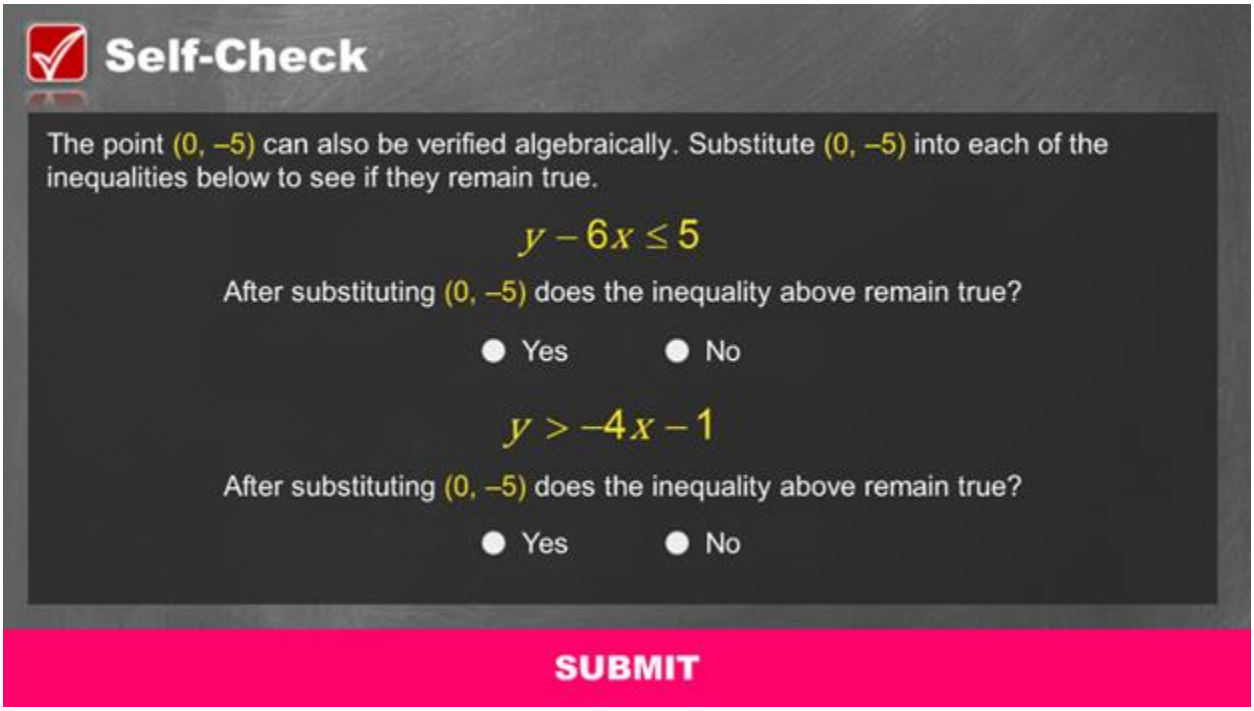
Solve the problem in the image above to check your understanding of the content.

Self-Check 2: Answer



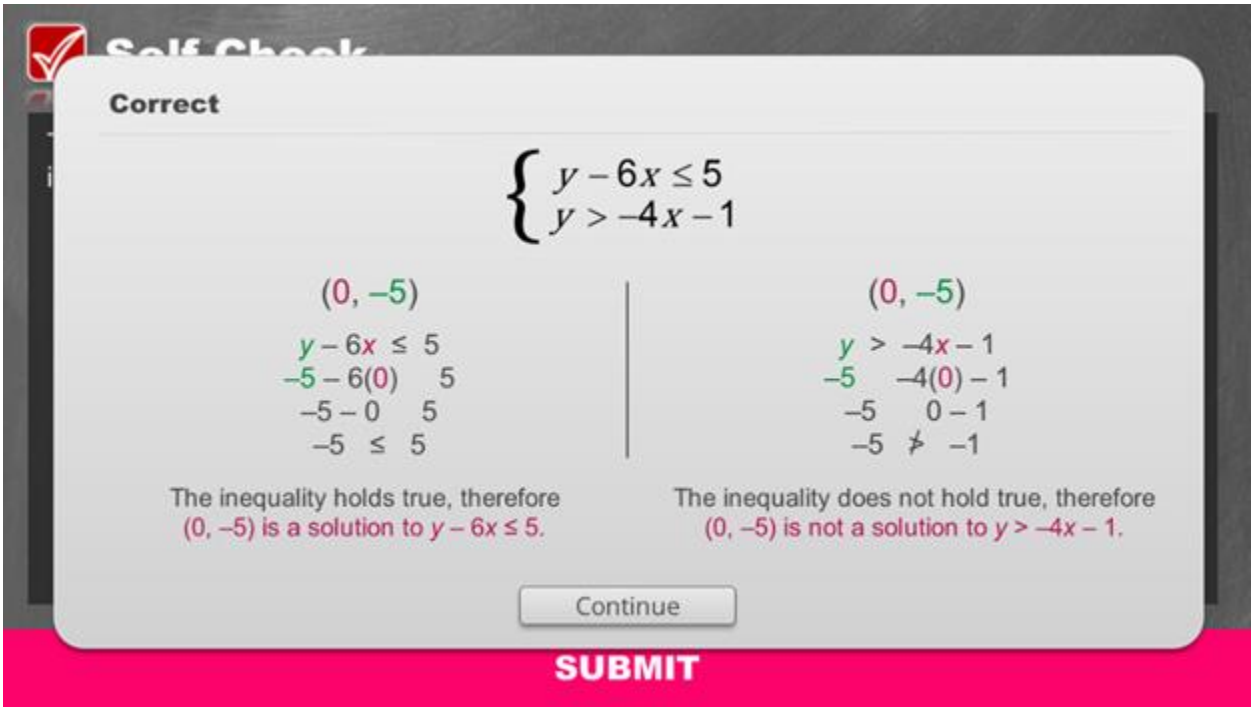
For your reference, the image above shows the correct solution to the self-check problem.

Self-Check 3



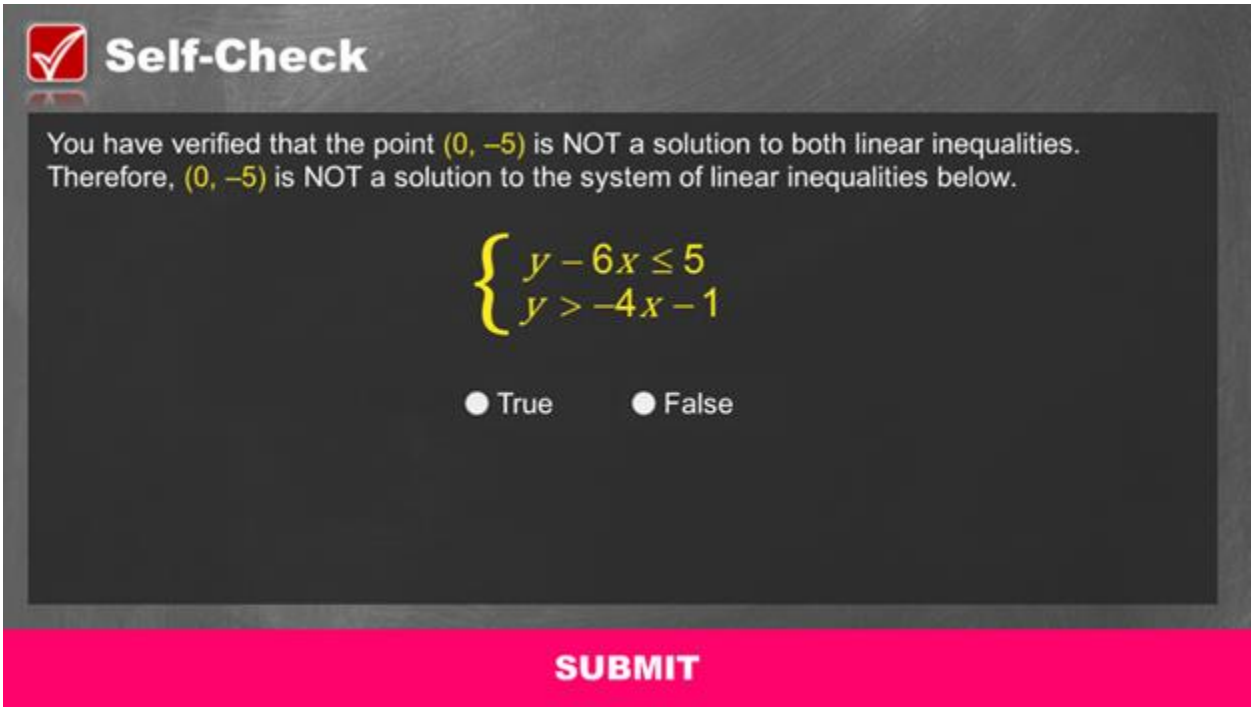
Solve the problem in the image above to check your understanding of the content.

Self-Check 3: Answer



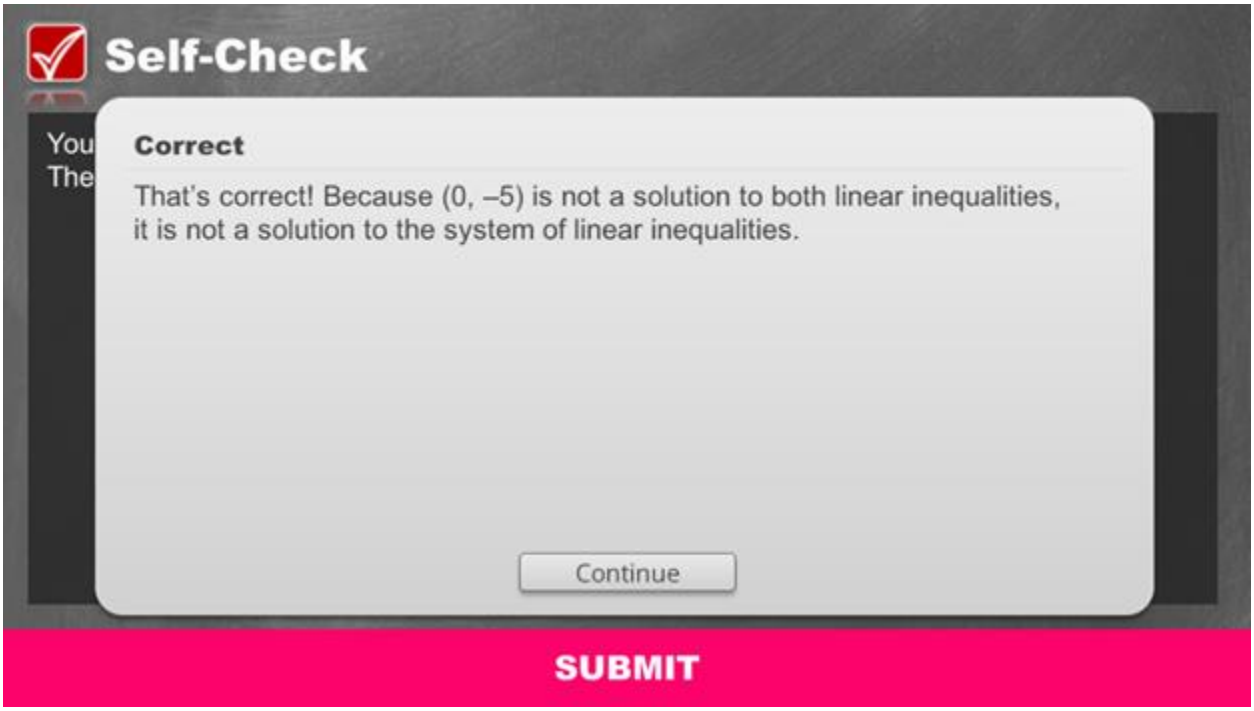
For your reference, the image above shows the correct solution to the self-check problem.

Self-Check 4



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

Self-Check 4: Answer



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

Conclusion

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.