## Lesson 21: Graphing Linear Inequalities in Two Variables (Part 1)

* Let’s find out how to use graphs to represent solutions to inequalities in two variables.

### 21.1: Math Talk: Less Than, Equal to, or More Than 12?

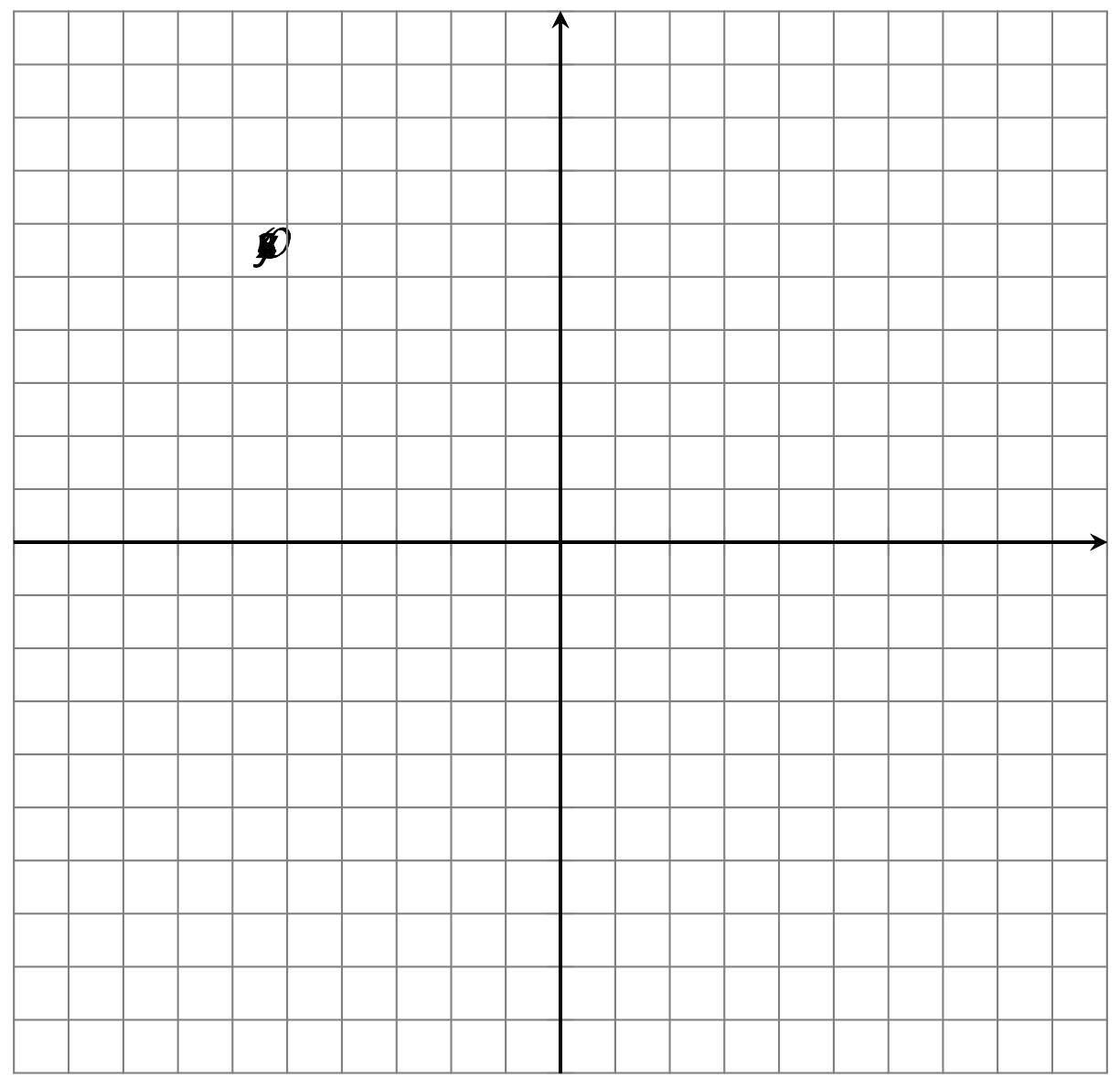
Here is an expression: .

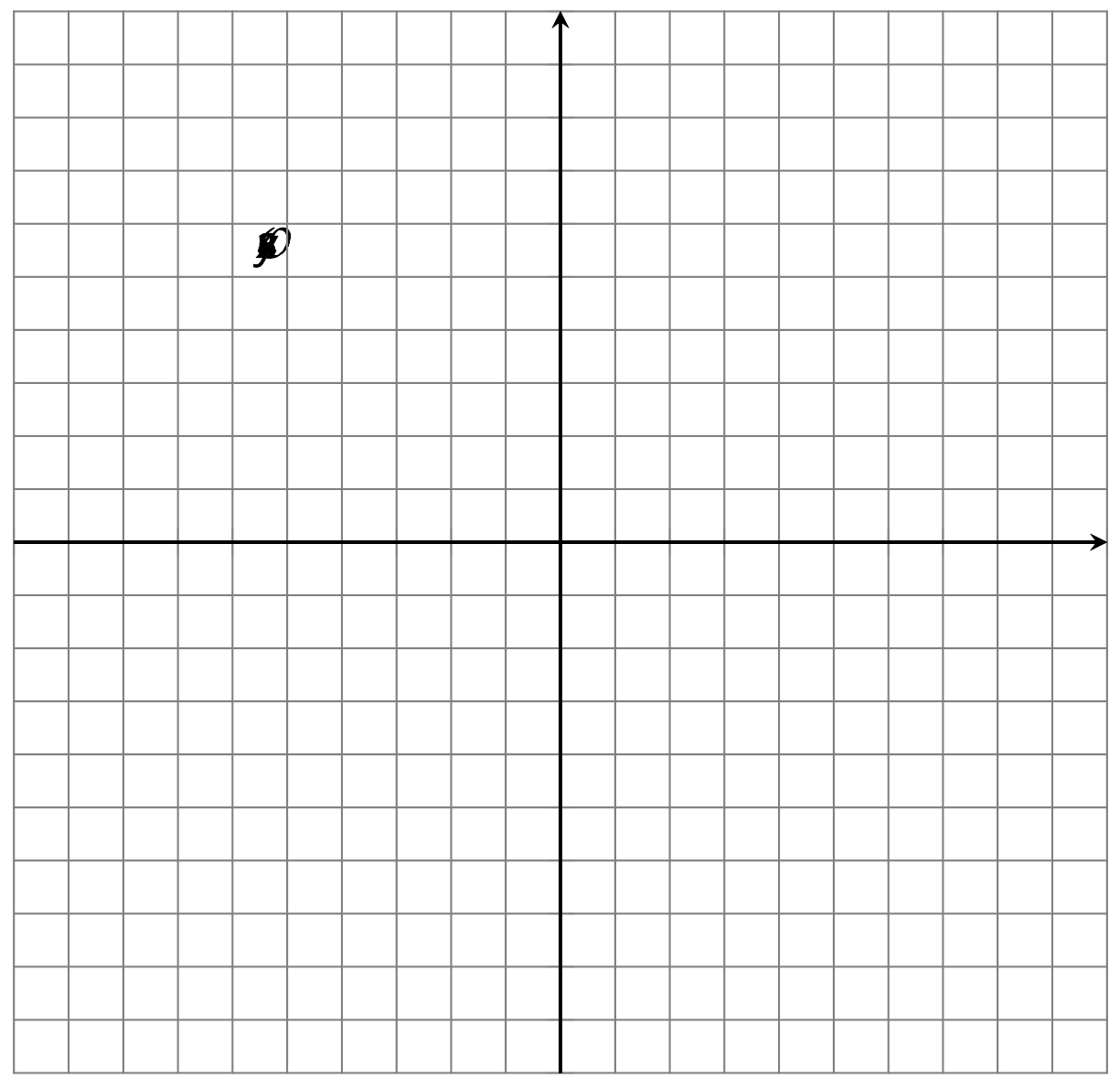
Decide if the values in each ordered pair, , make the value of the expression less than, greater than, or equal to 12.

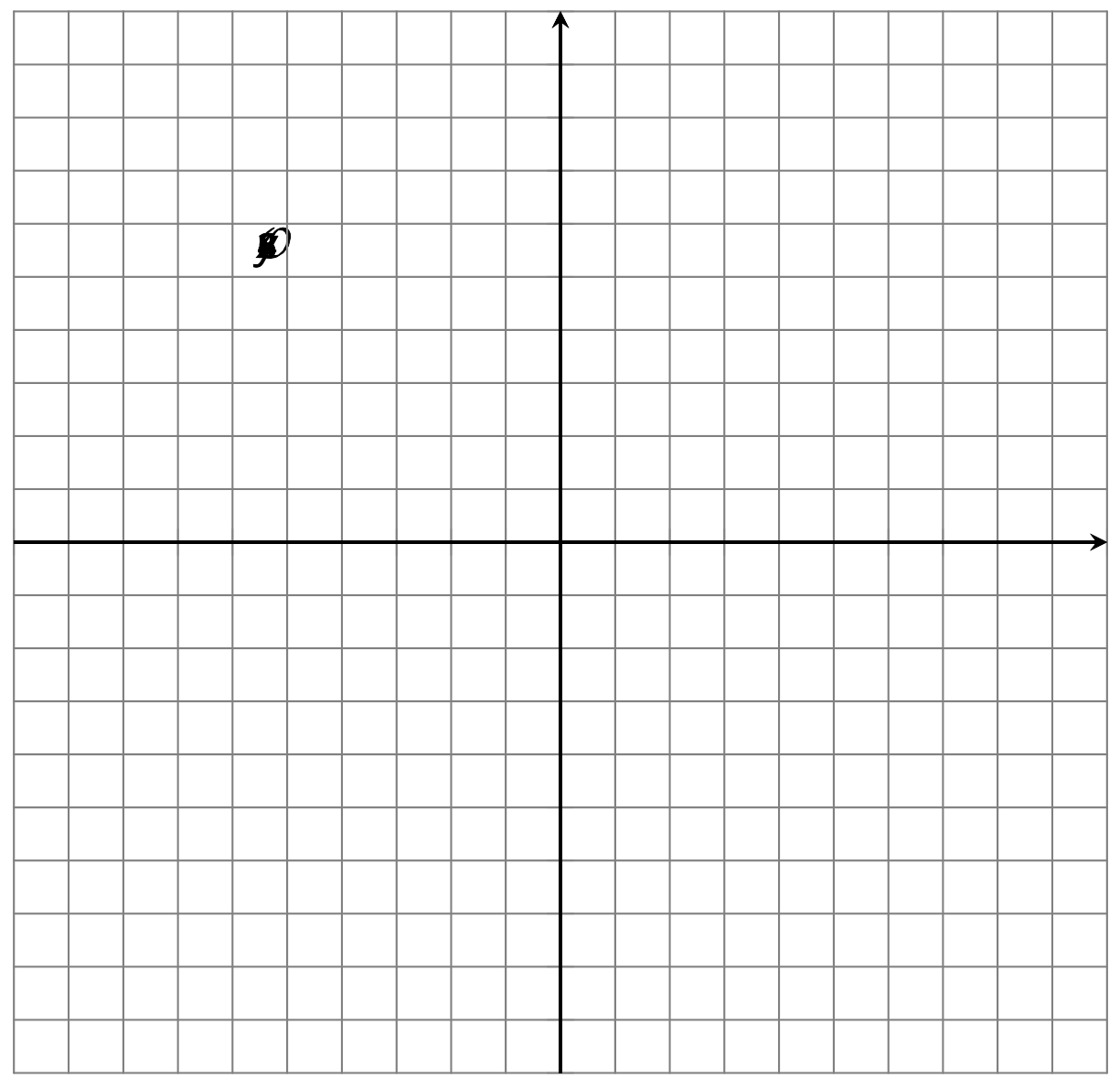
### 21.2: Solutions and Not Solutions

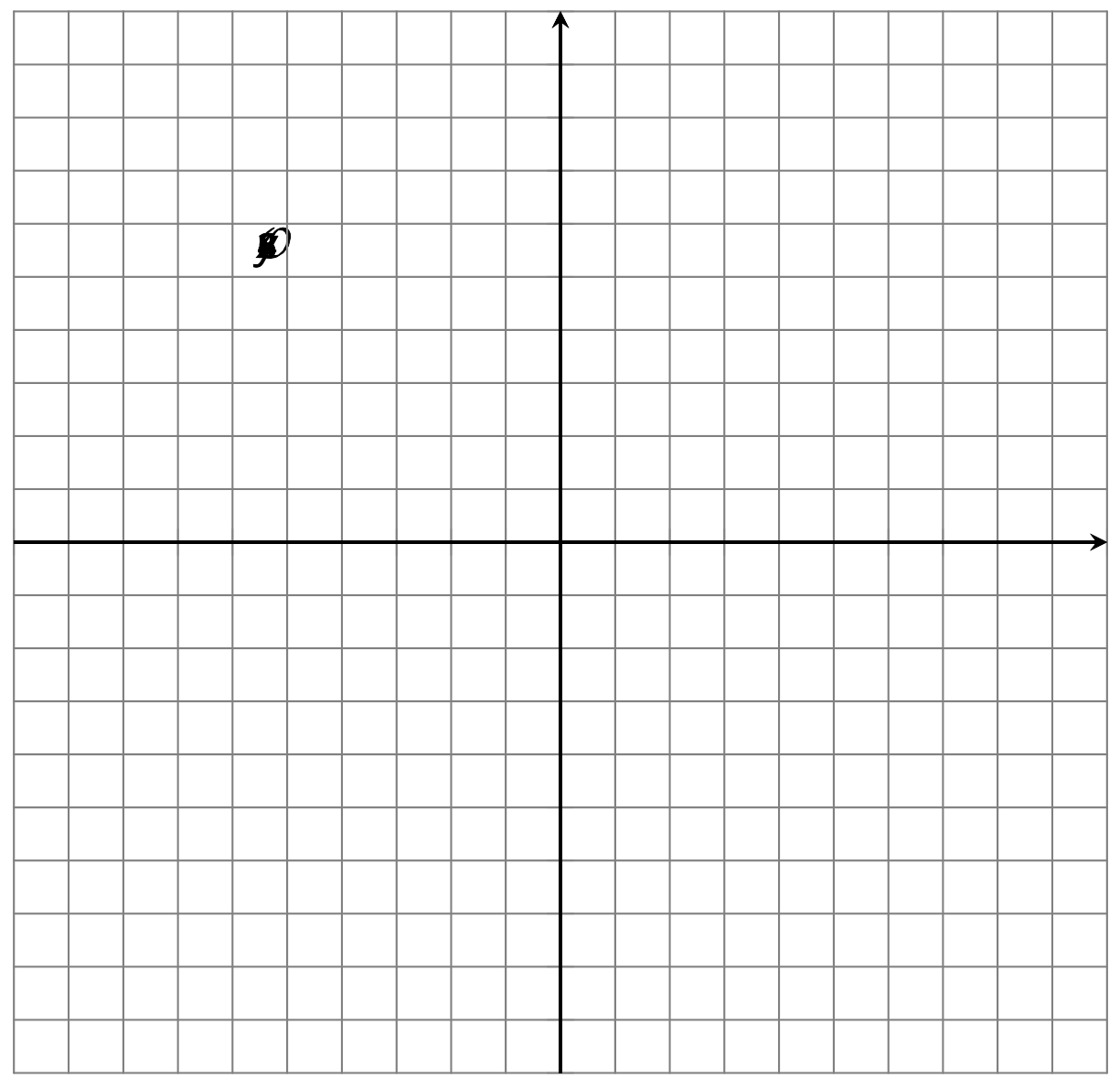
Here are four inequalities. Study each inequality assigned to your group and work with your group to:

* Find some coordinate pairs that represent solutions to the inequality and some coordinate pairs that do not represent solutions.
* Plot both sets of points. Either use two different colors or two different symbols like X and O.
* Plot enough points until you start to see the region that contains solutions and the region that contains non-solutions. Look for a pattern describing the region where solutions are plotted.



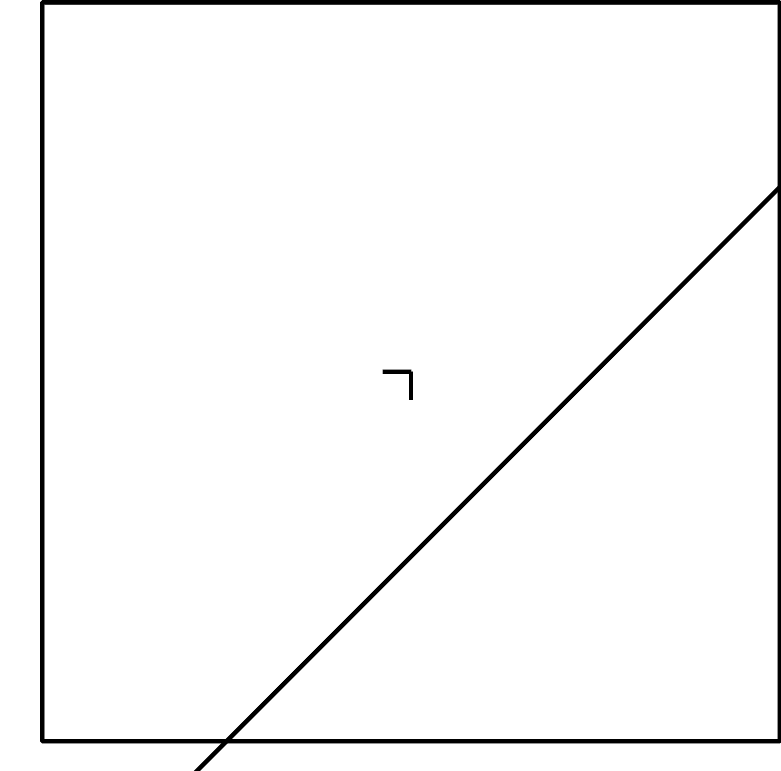
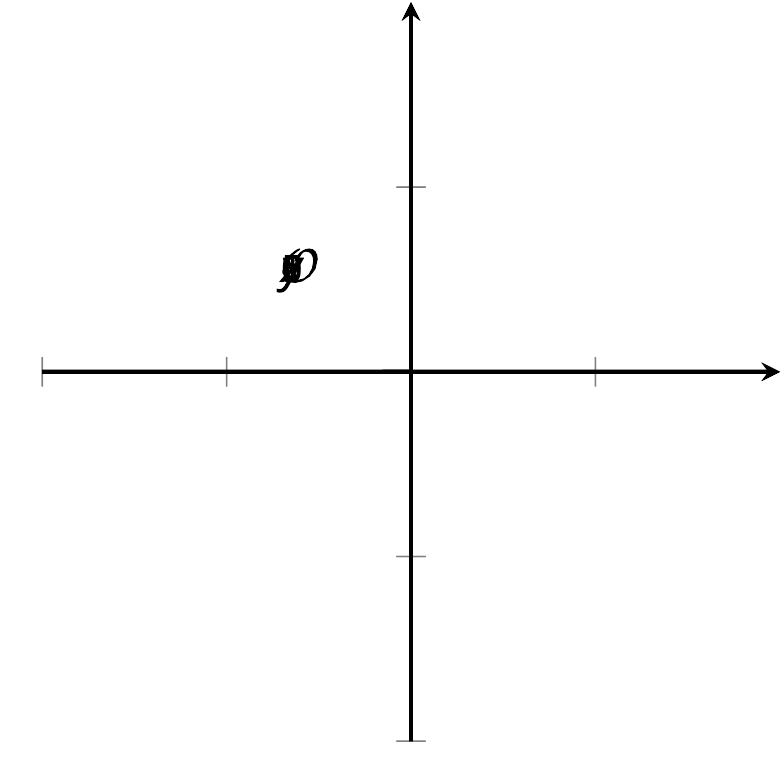
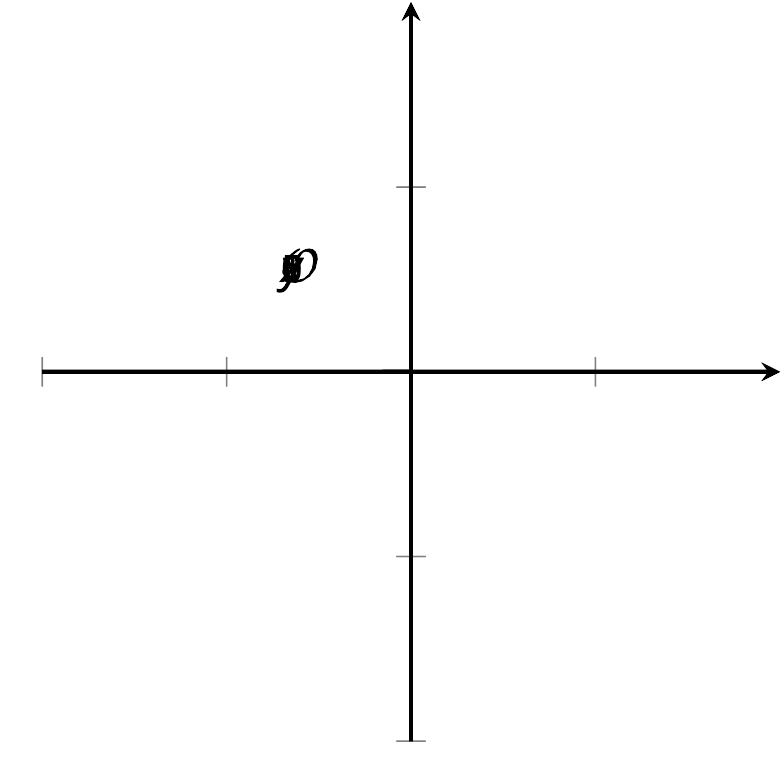
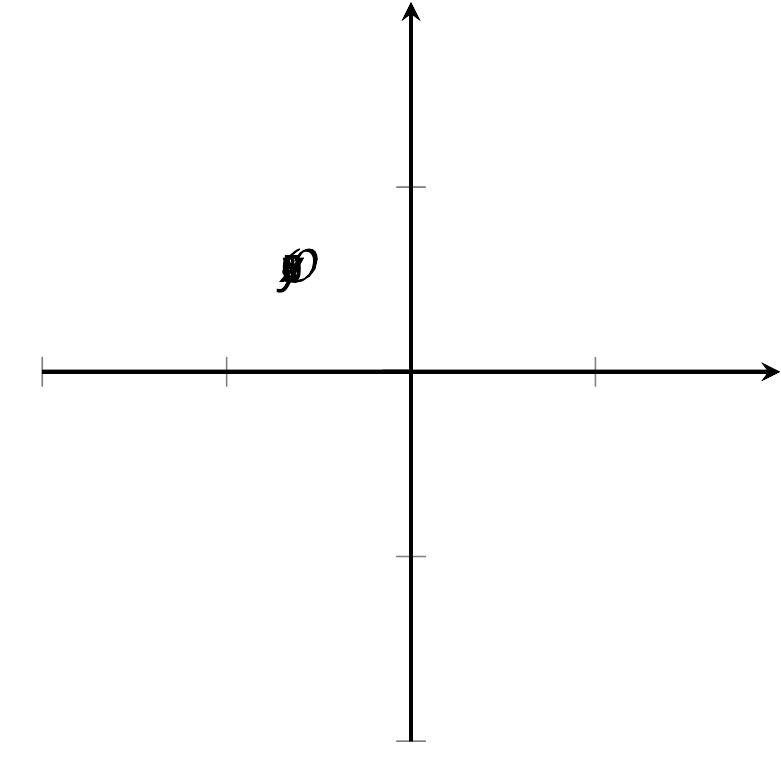
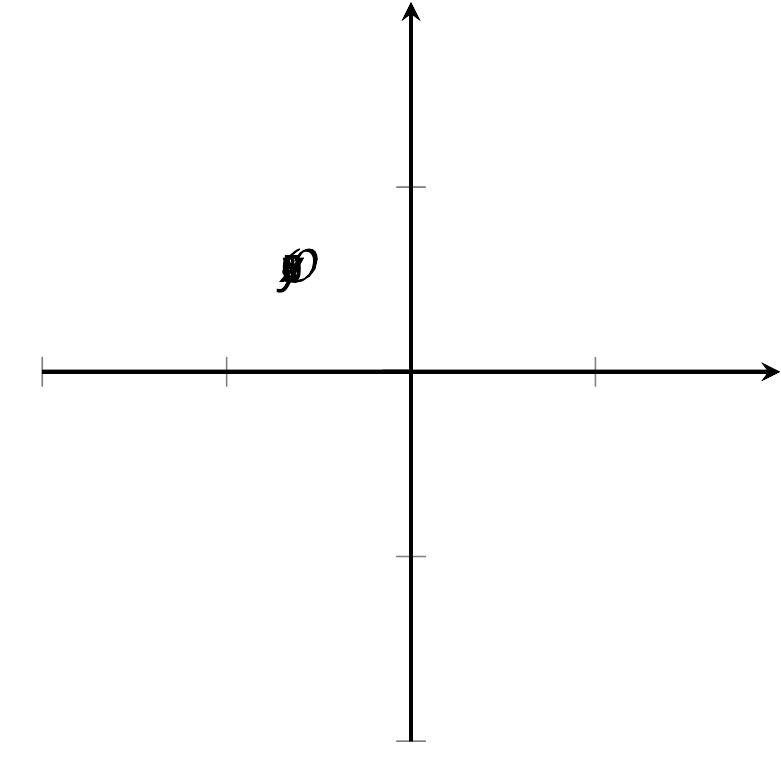




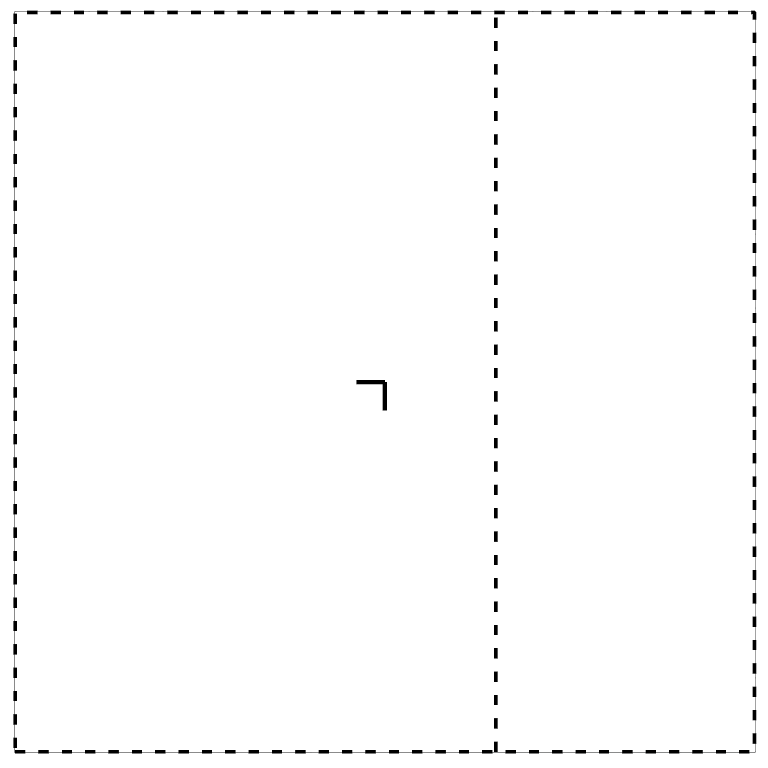
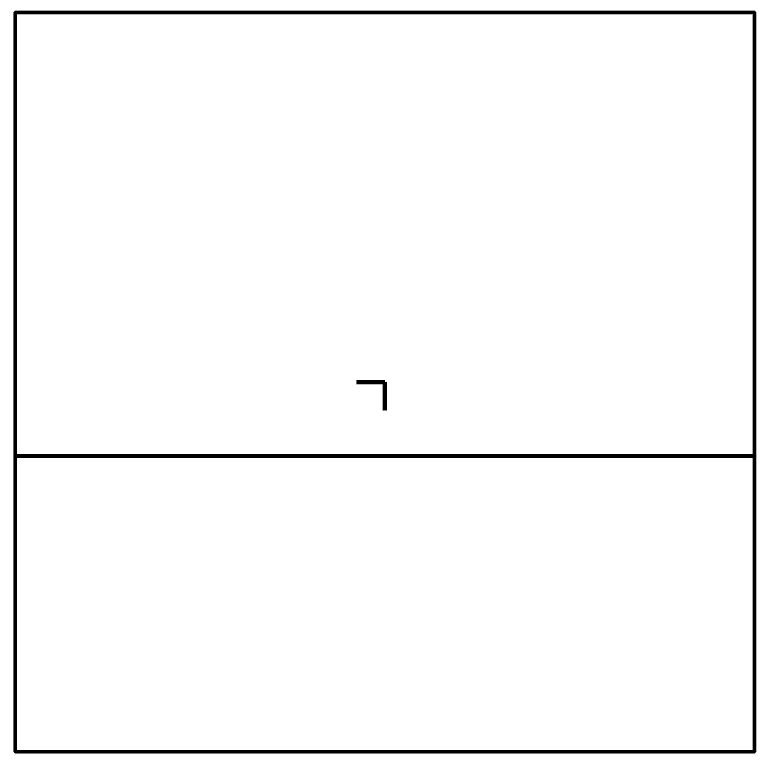
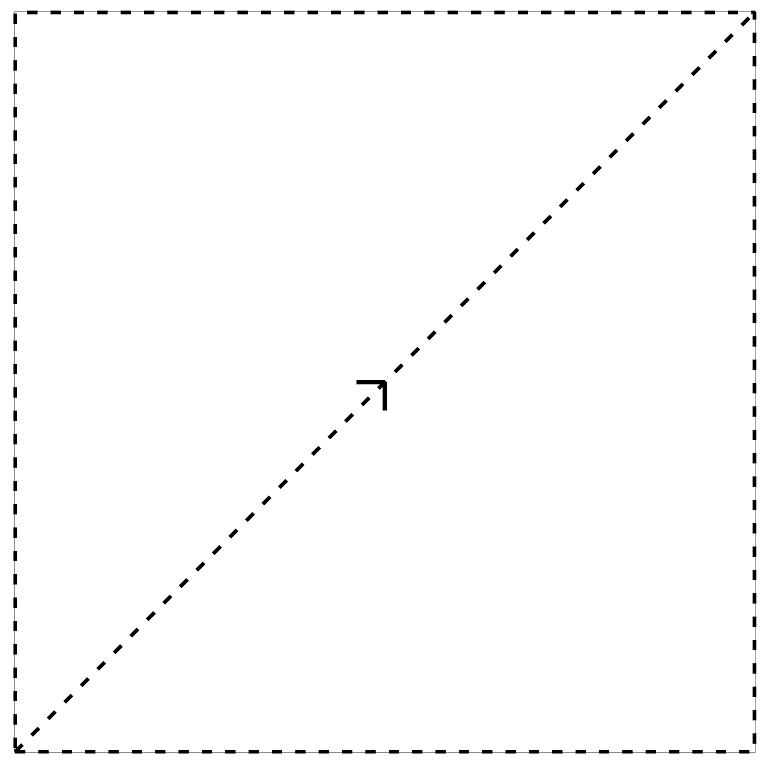
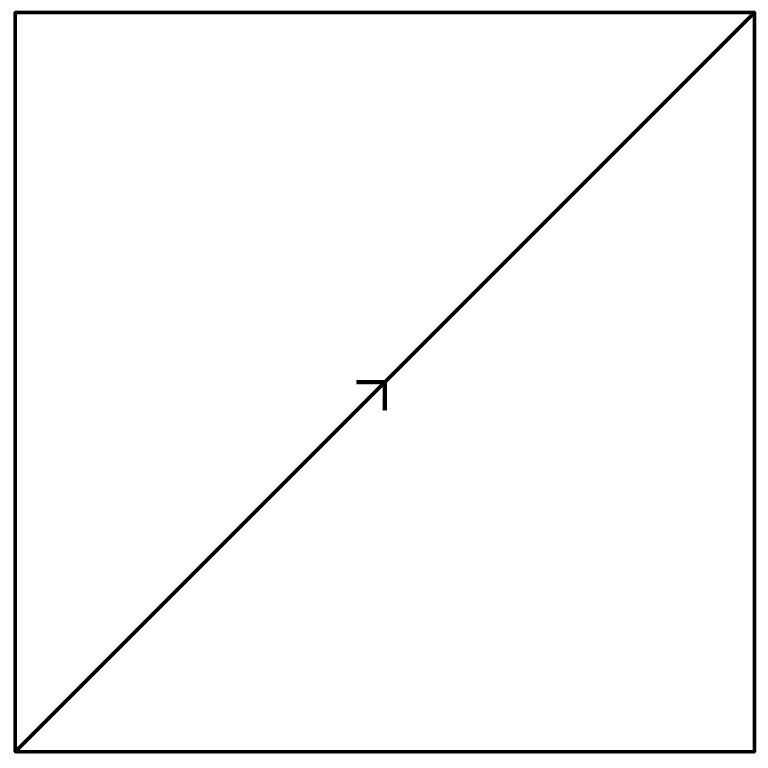


### 21.3: Sketching Solutions to Inequalities

1. Here is a graph that represents solutions to the equation .

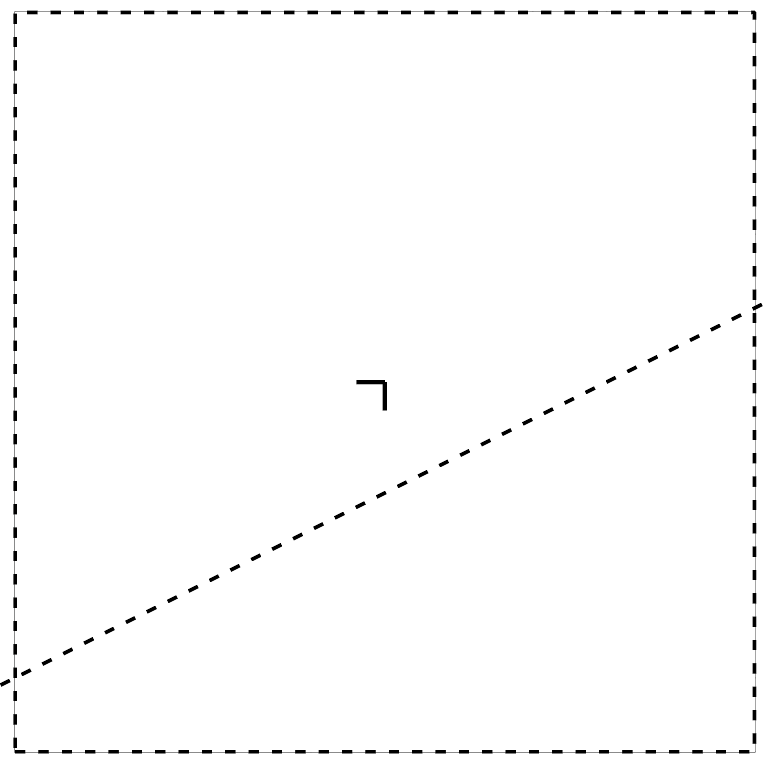
* 
* Sketch 4 quick graphs representing the solutions to each of these inequalities:
* 
* 
* 
* 

1. For each graph, write an inequality whose solutions are represented by the shaded part of the graph.

* A
* 
* B
* 
* C
* 
* D
* 

#### Are you ready for more?

1. The points and are both in the solution region of the inequality .
   1. Compute for both of these points.
   2. Which point comes closest to satisfying the equation ? That is, for which pair is closest to 3?

* 

1. The points and are also in the solution region. Which of these points comes closest to satisfying the equation ?
2. Find a point in the solution region that comes even closer to satisfying the equation . What is the value of ?
3. For the points and , . Find another  point in the solution region for which .
4. Find for the point . Then find two other points that give the same answer.

### Lesson 21 Summary

The equation is an equation in two variables. Its solution is any pair of and whose sum is 7. The pairs  and  are two examples.

We can represent all the solutions to by graphing the equation on a coordinate plane.

The graph is a line. All the points on the line are solutions to .



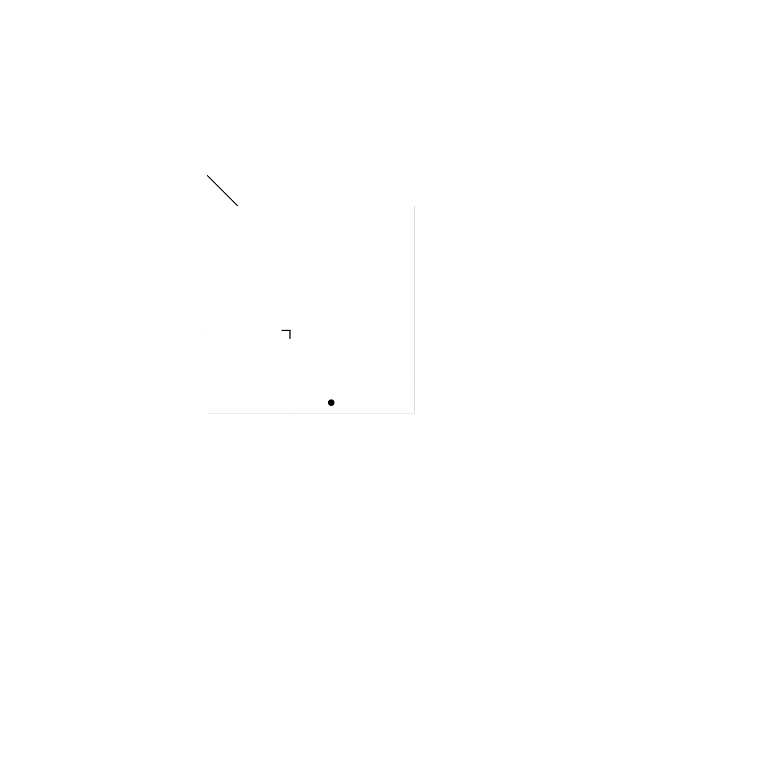
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The inequality is an inequality in two variables. Its solution is any pair of and whose sum is 7 or less than 7.

This means it includes all the pairs that are solutions to the equation , but also many other pairs of and that add up to a value less than 7. The pairs  and are two examples.

On a coordinate plane, the solution to includes the line that represents . If we plot a few other pairs that make the inequality true, such as and , we see that these points fall on one side of the line. (In contrast, pairs that make the inequality false fall on the other side of the line.)

We can shade that region on one side of the line to indicate that all points in it are solutions.



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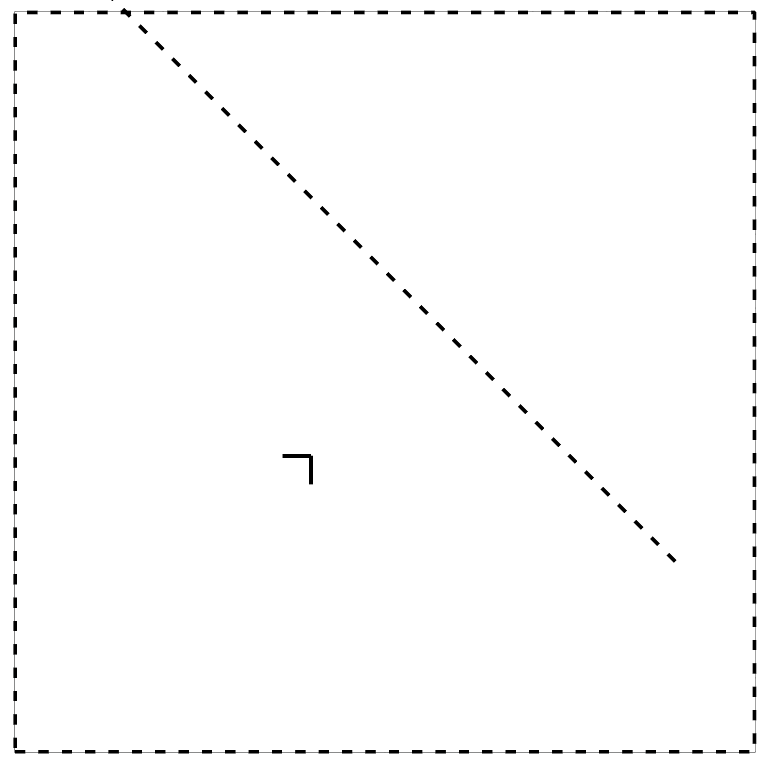
What about the inequality ?

The solution is any pair of and whose sum is less than 7. This means pairs like and  are *not* solutions.

On a coordinate plane, the solution does not include points on the line that represent  (because those points are  and pairs whose sum is 7).

To exclude points on that boundary line, we can use a dashed line.

All points below that line are pairs that make true. The region on that side of the line can be shaded to show that it contains the solutions.



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