LessonTitle: Graphing Inequalities Alg 6.6

Utah State Core Algebra Content Standard 2.2 Process Standards 1-5

Summary

In this lesson, four students in a group each analyze an inequality statement. They substitute points (from all four quadrants with x and y values from -3 to +3) into the inequality to evaluate greater than, less than, or equal. After the analysis, students compare results, and examine the patterns in the table they have created. Then they shade in graphs based on the patterns they observed in the four inequalities.

Enduring Understanding	Essential Questions
Real life situations often involve a broad range of possibilities within a defined boundary. Algebra helps us solve these complex problems involving interrelated situations with common variables.	How do you represent interrelated information mathematically? How does this communication help us solve problems?
Skill Focus	**Vocabulary Focus**
• Graphing inequalities	Expressions, Equations, Inequalities "students need to know inequality symbols and what they mean as well as substitution with two variables"

Materials Calculators and Computers

Launch ideas Use the essential understanding to help with the introduction to this lesson.

"We all agreed that this activity would require quite a bit of modeling. We thought that we would make up our own additional statement and model the process described in the worksheet with two or three points. We would probably make an overhead transparency of the worksheet. We thought that it might be good to emphasize to the students that they will be discovering for themselves how to graph inequalities, so, they need to be looking for patterns."
"We will relate boundry lines in basketball, volleyball, or baseball comparing them to how points are scored. We will have the students predict using the essential question."
"explain inequality signs and how to test for points. What does it mean when you need to test a point and what does the answer mean?"

Explore ideas The teacher will need to guide students in this investigation. After the initial introduction, this guidance will be better served with small groups and not with the entire class.

"The majority consensus decided to have the students work on the worksheet as a jigsaw. In their initial groups of four they would all work on substituting values in for the same statement. In these groups they would work on the majority of the worksheet, all through question number four. After having completed the work on their statement in these groups and feeling comfortable with the patterns that they had discovered each member of these first groups would prepare to present the five different possible graphs of their statement to another small group. At this point, the student would be broken up into groups with the same number of people in the group as there were small groups working on different equations. (For example if there were twenty-eight students in the class there would be seven groups of four working on seven different statements. Then, for the jigsaw there would be four groups of seven where each group member each had graphed a different statement). After each group member presented their graphs the students should be able to easily answer question number five to complete their worksheet."

"The teacher will demonstrate how to do this activity with problem 1a then the students will divide into small groups to do 1b, 1c, and 1d. The teacher must monitor the students to ensure on-task behavior while they are in their gourps. While the students are in their groups working they must lean on fellow group members for help while working their problem. When everyone has completed their part they should check each others work for accuracy."

"Start with only y _ 1x + 1. You need a slope of one so the graph looks nice. There will be no jumps between the equal signs on the circle graph. This will create a nice boundary line. Pass the testing points out to the students to test. They then will put appropriate inequality/equal sign on a poster that looks like the circle graph. Each sign should be a different color. It will make checking the points easier and the students will see a pattern quicker. Transfer to an overhead of the poster that matches a normal x-y grid. Then take the pattern and create the 5 graphs that will correspond. By having the overhead, it will be easy."

Summarize ideas

"We felt that the summary could mostly consist of testing whether they could apply the rules that they discovered to graph inequalities. Most likely we would want to make sure that they all understood when to use shading and when

to use dashed lines. We also thought that we could test whether they could apply these rules by having them graph several inequalities on white board or at least have them describe how they would graph the inequalities." "Jigsaw - students will regroup, discuss their results, then present the groups final answers." "The next day do again with y _ -1x + 1 and compare the graphs to each other. The shading will be different so make sure to emphasize and question why"
Apply
Assess

Directions: Use the broad understanding to help with the introduction to this lesson. The teacher will need to guide students in this investigation. After the initial introduction, this guidance will be better served with small groups and not with the entire class.

Name_____ Period _____

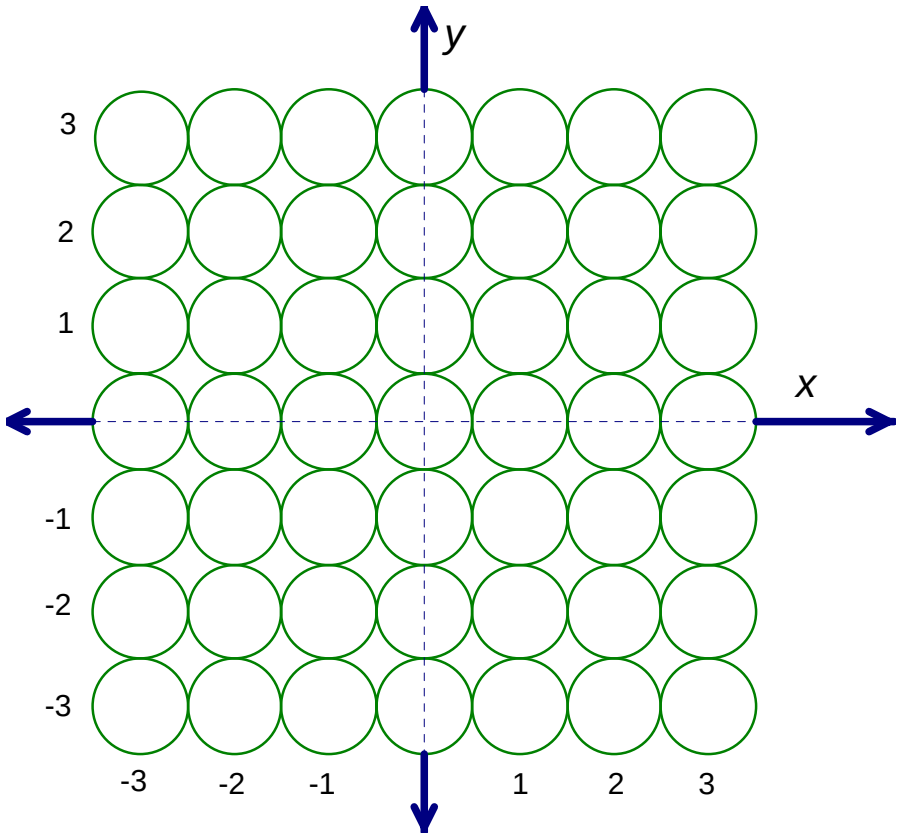
Alg 6.6 Graphing Inequalities

1. Each member of your group should choose a different statement from below:
   a. $y \leq 0.5x + 1$
   b. $y \leq -2x + 1$
   c. $y \leq -0.5x + 1$
   d. $y \leq -2x - 1$
2. Use the coordinates of each point shown with a circle on the plane below to test the statement you selected. Fill in each circle with the symbol <, >, or = that makes the statement true.

   For example, to test the upper left point in statement a, substitute (-3, 3) for (x, y) as follows:

y	$\leq$	$1 + 1.5x$	*Original statement*
3	$\leq$	$1 + 1.5(-3)$	*Substitute 3 for y and -3 for x.*
3	>	-0.5	*Evaluate and choose the symbol.*

Then you would place a ">" in the upper left circle because this symbol makes statement a true.



My statement is: _____

Use the table below to investigate each of the coordinates on the plane. Remember to insert the appropriate symbol for the relationship between the ordered pair in the circle plane on the other side of this paper. **Be careful; remember the x-value comes first in an ordered pair**.

(-3, 3)	(-2, 3)	(-1, 3)	(0, 3)	(1, 3)	(2, 3)	(3, 3)
(-3, 2)	(-2, 2)	(-1, 2)	(0, 2)	(1, 2)	(2, 2)	(3, 2)
(-3, 1)	(-2, 1)	(-1, 1)	(0, 1)	(1, 1)	(2, 1)	(3, 1)
(-3, 0)	(-2, 0)	(-1, 0)	(0, 0)	(1, 0)	(2, 0)	(3, 0)
(-3, -1)	(-2, -1)	(-1, -1)	(0, -1)	(1, -1)	(2, -1)	(3, -1)
(-3, -2)	(-2, -2)	(-1, -2)	(0, -2)	(1, -2)	(2, -2)	(3, -2)
(-3, -3)	(-2, -3)	(-1, -3)	(0, -3)	(1, -3)	(2, -3)	(3, -3)

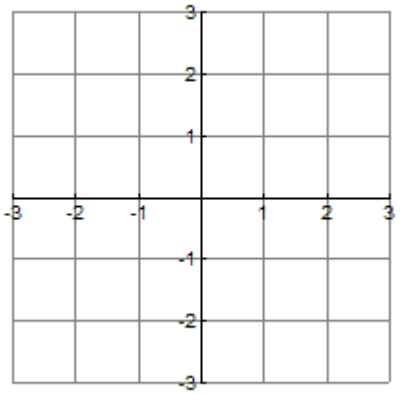
3. Now analyze the results of your graph:
    a. What do you notice about the circles filled with the equal signs? Tell about any other patterns that you see.

b. Test a point with fraction or decimal coordinates that is not represented by a circle on the grid.

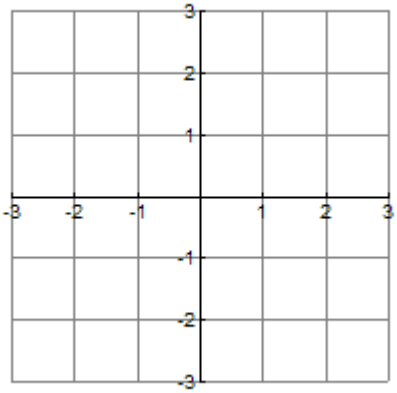
My point is _____. Substitute this point into your equation.

How does this point compare with the other points on the same side of the line of equal signs?

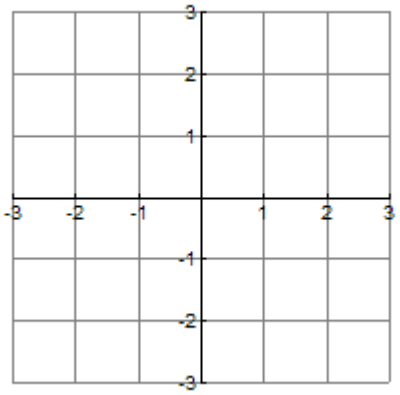
4. Complete the lines below the graphs with the missing part of your statement and then, on the graph, shade the region that makes that statement true. If the points on the line make an inequality true draw a solid line through them. If not, draw a dashed line.



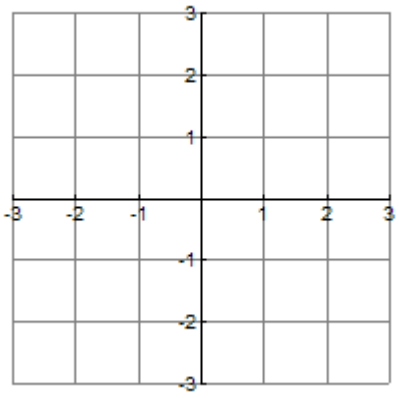
y < _____



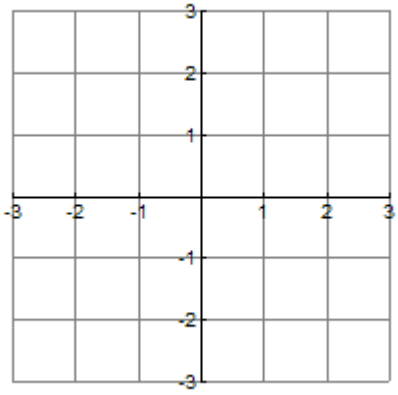
y > _____



y ≤ _____



y ≥ _____



y = _____

5. Compare your graphs with the graphs of your group members.
    a. What graphs require a solid line?

    b. What graphs require a dashed line?

    c. What graphs require shading?

        i. Shading above the line?

        ii. Shading below the line?

    d. Explain how you can check the graph of an inequality with one point?