Graphing Systems of Inequalities

Reporting Category	Equations and Inequalities
Topic	Graphing systems of inequalities
Primary SOL	A.5d The student will solve multistep linear inequalities in two variables, including solving systems of inequalities.
Related SOL	A.5a, A.6

Materials

- What Can I Buy? activity sheet (attached)
- Graphing calculators
- Graphing Systems of Inequalities activity sheet (attached)
- Graph paper (or individual white boards with the coordinate plane)
- Colored pencils or markers in different colors

Vocabulary

inequality, solution (earlier grades)

system of inequalities (A.5)

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Introduce systems of inequalities by first reviewing systems of equations. Then, distribute copies of the What Can I Buy? activity sheet, and have students complete it, using graphing calculators.
2. Distribute copies of the Graphing Systems of Inequalities activity sheet, sheets of graph paper (or individual white boards with the coordinate plane), and colored pencils or markers in different colors. As students work on each of the examples, model the graphing for all to see.

Assessment

- **Questions**
  - How would you write a system of linear inequalities where (2,4) is a solution and (−3,2) is not a solution? Justify your answer with a graph.
  - How would you graph this system of linear inequalities?

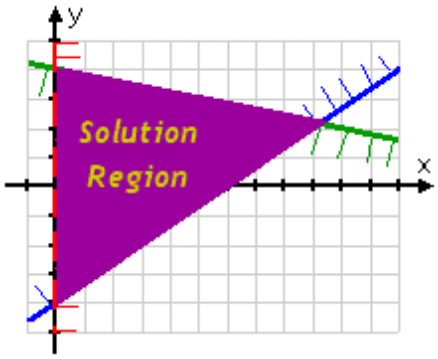
    $x \geq 0$

    $y \geq 0$

    $2x + 3y < 12$

    Is (3,2) a solution to the system? Is (0,0) a solution to the system? How can you justify the difference in your answers to these questions?
- **Journal/Writing Prompts**
  - Explain the situation when a system of two inequalities would have no solution. Give an example to support your reasoning.
  - Explain the situation when the solution of a system of inequalities would be a horizontal strip. Give an example to support your reasoning.

- **Other**
  - Have students write the system of linear inequalities that defines the solution shown below.

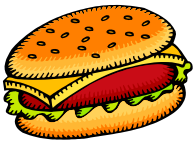
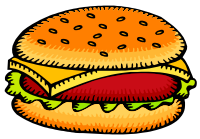


Extensions and Connections (for all students)

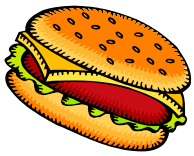
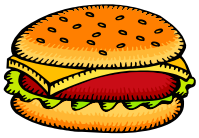
- Have students write a system of inequalities that shows the various numbers of hours they could work at each job in the following scenario: "You can work a total of no more than 20 hours per week at your two jobs. Baby-sitting pays $8 per hour, and your job as a cashier pays $10 per hour. You need to earn $120 per week to cover your expenses." Then, have students graph the system of linear inequalities and give two possible ways they could divide their hours between the two jobs to achieve their goal.

Strategies for Differentiation

- Have students use grid paper or individual white boards with the coordinate plane to help them create more accurate graphs.
- Put painters tape on the classroom tile floor to represent the *x*-axis and *y*-axis of a large coordinate plane. Have students graph on the floor, using different colored string or yarn for each inequality. Use large sheets of colored paper for the shading. This method is best used with small cooperative learning groups.
- Have students graph a system of two inequalities by graphing each inequality on a separate transparency and then placing one graph on top of the other to see the solution.

What Can I Buy?

Name _____ **Date**_____

You are very hungry, so you go to a fast food restaurant. You have exactly $15.02. You love Big Burgers and cheeseburgers. Based on past experience, you know that you can eat only 7 sandwiches. Big Burgers cost $3.70, while cheeseburgers cost $.98. How many Big Burgers and how many cheeseburgers can you buy? (Disregard the issue of sales tax in this problem.)

1. Write a system of equations for this problem. Let *B* represent the number of Big Burgers and *C* represent the number of a cheeseburgers you can buy.

2. Graph this system of equations. It is recommended that you use a graphing calculator to do this.

3. You can buy _____ Big Burgers and _____ cheeseburgers.

4. Now, suppose you decide that you don't want to spend all your money. Also, you realize that it would be fine to eat fewer than 7 sandwiches. Write a system of inequalities for this new problem.

5. Graph this system of inequalities.

6. How many different sandwich combinations can you buy to fulfill your new criteria? Complete the chart at right, showing all the possible combinations.

7. Notice that systems of inequalities have *many* solutions.

Big Burgers	Cheese-burgers
0	1
0	2
0	
0	
0	
0	
0	
1	
1	
1	
1	
1	
1	
1	
2	
2	
2	
2	
2	
2	
3	
3	
3	
3	
4	

Graphing Systems of Inequalities

Name _____ **Date**_____

Using sheets of graph paper (or a white board with the coordinate plane) and colored pencils or markers in different colors, complete each of the following systems of inequalities. Show your work.

Example 1

$2x - y > -3$

$4x + y \geq 5$

1. Solve each inequality for y.

2. Graph each inequality, using a different color for each. Shade below the dotted line in the first inequality. Shade above the solid line in the second inequality.
3. Identify the solution.

4. Pick a point from the solution set, and test it in the system.

Example 2

$x - y \leq -2$

$x - y > 2$

1. Solve each inequality for y.

2. Graph each inequality, using a different color for each. Shade above the solid line in the first inequality. Shade below the dotted line in the second inequality.
3. Identify the solution.

4. Check.

Example 3

$x < 1$

$x \leq -2$

1. Graph each inequality, using a different color for each. Shade to the left of the dotted line in the first inequality. Shade to the left of the solid line in the second inequality.
2. Identify the solution.

Teacher Notes for Graphing Systems of Inequalities

Using sheets of graph paper (or a white board with the coordinate plane) and colored pencils or markers in three different colors, complete each of the following systems of inequalities.

Example 1

$2x - y > -3$

$4x + y \geq 5$

1. Solve each inequality for y.
   $y < 2x + 3$
   $y \geq -4x + 5$
2. Graph each inequality, using a different color for each. Shade below the dotted line in the first inequality, and shade above the solid line in the second inequality.
3. Identify the solution.
   The solution to this system of inequalities is the region where the colors of shading overlap. This is the area that both inequalities have in common. This solution is "unbounded" and continues indefinitely to the right.
4. Pick a point from the solution set and test it in the system.

Example 2

$x - y \leq -2$

$x - y > 2$

1. Solve each inequality for y.
   $y \geq x + 2$
   $y < x - 2$
2. Graph each inequality using a different color for each. Shade above the solid line in the first inequality, and shade below the dotted line in the second inequality.
3. Identify the solution.
   This system of inequalities has no solution. There is no place where the colors of shading overlap.
4. Check.

Example 3

$x < 1$

$x \leq -2$

1. Graph each inequality using a different color for each. Shade to the left of the dotted line in the first inequality, and shade to the left of the solid line in the second inequality.
2. Identify the solution.
   The solution to this system of inequalities is the region where the colors of shading overlap.