

## Lesson 21: Solution Sets to Inequalities with Two Variables

### Classwork

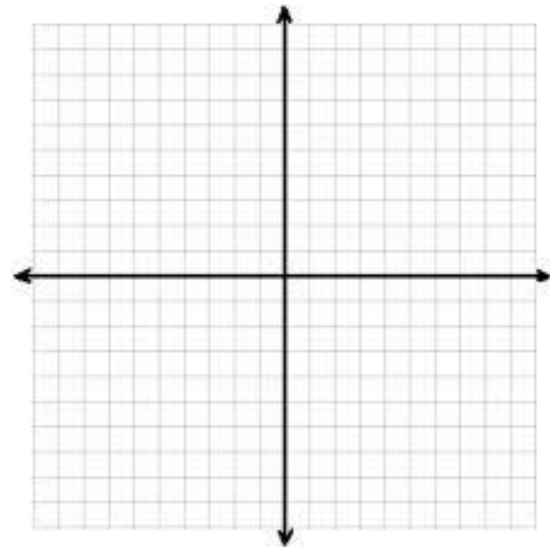
#### Exercise 1

- a. Circle each ordered pair  $(x, y)$  that is a solution to the equation  $4x - y \leq 10$ .

i.    3,2        2,3        -1, -14        0,0        1, -6

ii.   5,10       0, -10       3,4        6,0        4, -1

- b. Plot each solution as a point  $(x, y)$  in the coordinate plane.



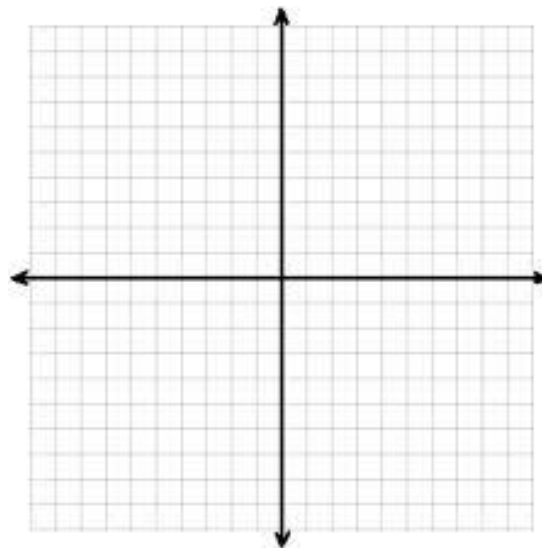
- c. How would you describe the location of the solutions in the coordinate plane?

## Exercise 2

- a. Discover as many additional solutions to the inequality  $4x - y \leq 10$  as possible. Organize your solutions by plotting each solution as a point  $(x, y)$  in the coordinate plane. Be prepared to share the strategies used to find your solutions.

- b. Graph the line  $y = 4x - 10$ . What do you notice about the solutions to the inequality  $4x - y \leq 10$  and the graph of the line  $y = 4x - 10$ ?

- c. Solve the inequality for  $y$ .



- d. Complete the following sentence:

If an ordered pair is a solution to  $4x - y \leq 10$ , then it will be located \_\_\_\_\_

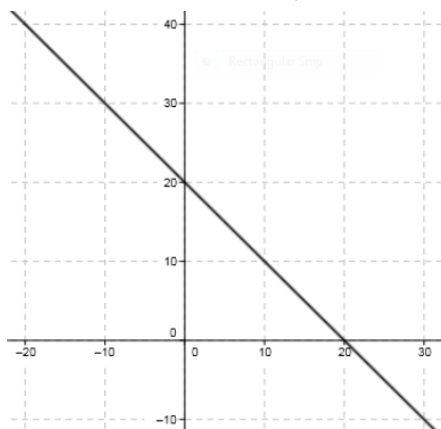
\_\_\_\_\_ the line  $y = 4x - 10$ .

Explain how you arrived at your conclusion.

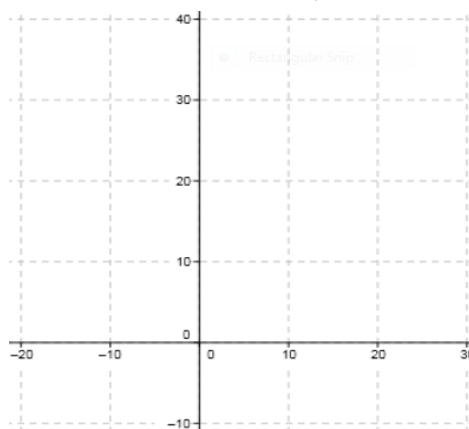
### Example 1

The solution to  $x + y = 20$  is shown on the graph below.

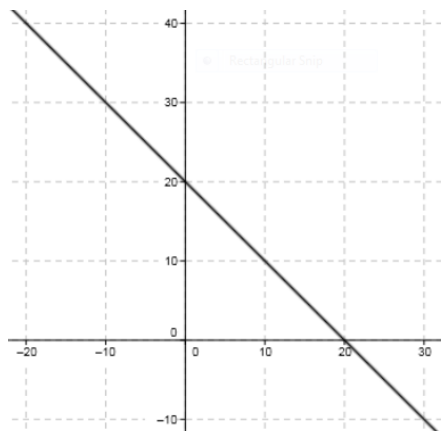
- a. Graph the solution to  $x + y \leq 20$ .



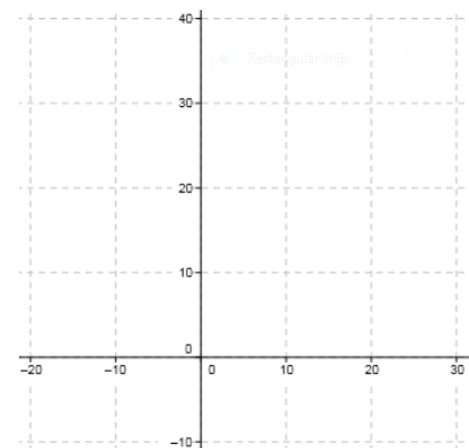
- c. Graph the solution to  $x + y < 20$ .



- b. Graph the solution to  $x + y \geq 20$ .



- d. Graph the solution to  $x + y > 20$ .



## Exercises 3–5

3. Using a separate sheet of graph paper, plot the solution sets to the following equations and inequalities:

a.  $x - y = 10$

g.  $y = 5$

m.  $x > 0$

b.  $x - y < 10$

h.  $y < 5$

n.  $y < 0$

c.  $y > x - 10$

i.  $x \geq 5$

o.  $x^2 - y = 0$

d.  $y \geq x$

j.  $y \neq 1$

p.  $x^2 + y^2 > 0$

e.  $x \geq y$

k.  $x = 0$

q.  $xy \leq 0$

Which of the inequalities in this exercise are *linear* inequalities?

A *half-plane* is the graph of a solution set in the Cartesian coordinate plane of an inequality in two real number variables that is linear and strict.

4. Describe in words the half-plane that is the solution to each inequality.

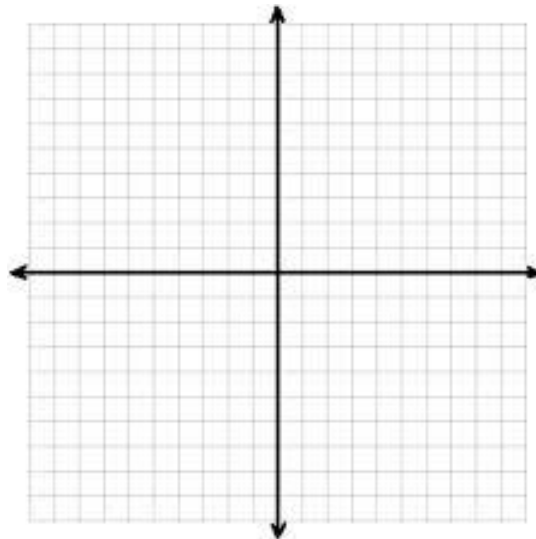
a.  $y \geq 0$

b.  $x < -5$

c.  $y \geq 2x - 5$

d.  $y < 2x - 5$

5. Graph the solution set to  $x < -5$ , reading it as an inequality in *one* variable, and describe the solution set in words. Then graph the solution set to  $x < -5$  again, this time reading it as an inequality in *two* variables, and describe the solution set in words.



**Lesson Summary**

An ordered pair is a **solution** to a two-variable inequality if, when each number is substituted into its corresponding variable, it makes the inequality a true number sentence.

Each ordered pair of numbers in the solution set of the inequality corresponds to a point on the coordinate plane. The set of all such points in the coordinate plane is called the **graph of the inequality**.

The graph of a linear inequality in the coordinate plane is called a **half-plane**.

**Problem Set**

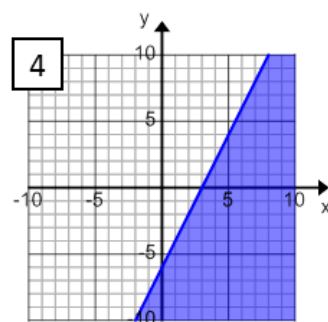
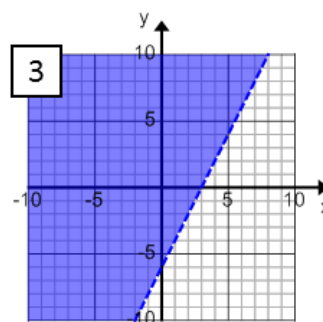
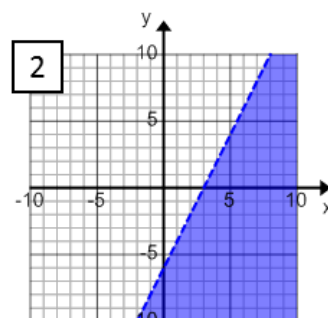
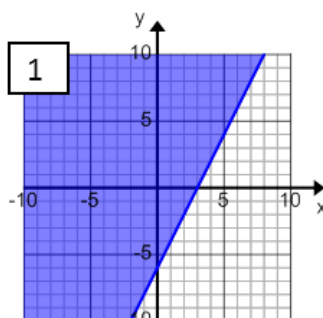
1. Match each inequality with its graph. Explain your reasoning.

a.  $2x - y > 6$

b.  $y \leq 2x - 6$

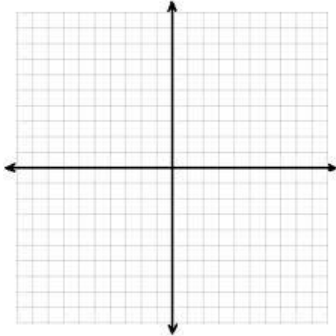
c.  $2x < y + 6$

d.  $2x - 6 \leq y$

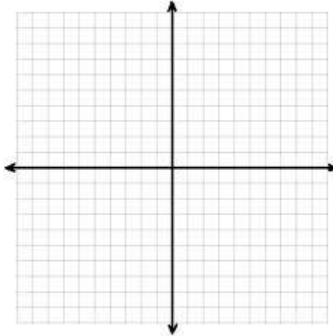


2. Graph the solution set in the coordinate plane. Support your answer by selecting two ordered pairs in the solution set and verifying that they make the inequality true.

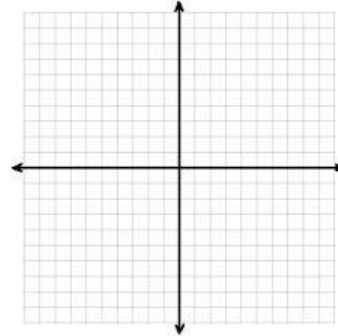
a.  $-10x + y > 25$



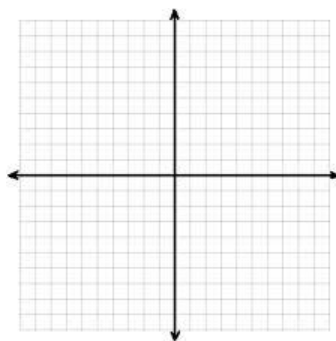
b.  $-6 \leq y$



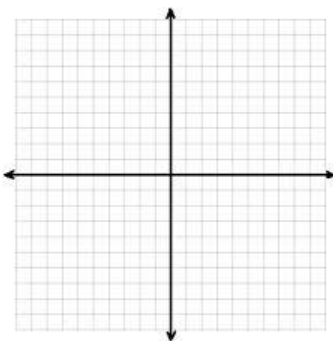
c.  $y \leq -7.5x + 15$



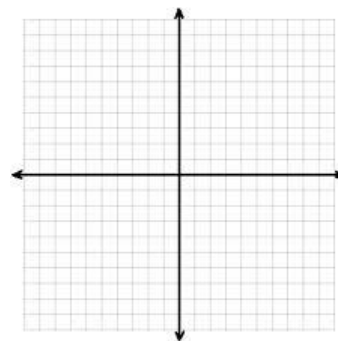
d.  $2x - 8y \leq 24$



e.  $3x < y$



f.  $2x > 0$



3. Marti sells tacos and burritos from a food truck at the farmers market. She sells burritos for \$3.50 each and tacos for \$2.00 each. She hopes to earn at least \$120 at the farmers market this Saturday.
- Identify three combinations of tacos and burritos that will earn Marti more than \$120.
  - Identify three combinations of tacos and burritos that will earn Marti exactly \$120.
  - Identify three combinations of tacos and burritos that will *not* earn Marti at least \$120.
  - Graph your answers to parts (a–c) in the coordinate plane and then shade a half-plane that contains all possible solutions to this problem.
  - Create a linear inequality that represents the solution to this problem. Let  $x$  equal the number of burritos that Marti sells, and let  $y$  equal the number of tacos that Marti sells.
  - Are the points  $(10, 49.5)$  a solution to inequality you created in part (e)? Explain your reasoning.