Lesson 22: Solution Sets to Simultaneous Equations

Classwork

Opening Exercise

Consider the following compound sentence: $x + y > 10$ and $y = 2x + 1$.

a. Circle all the ordered pairs (x, y) that are solutions to the inequality $x + y > 10$ (below).

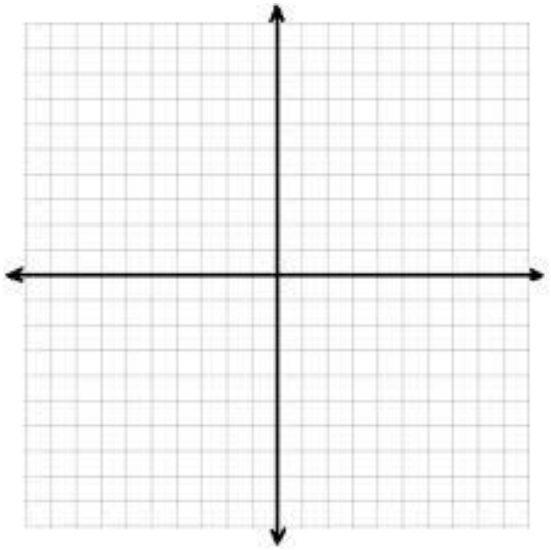
b. Underline all the ordered pairs (x, y) that are solutions to the equation $y = 2x + 1$.

$3, 7$	$7, 3$	$-1, 14$	$0, 1$	$12, 25$
$5, 11$	$0, 12$	$1, 8$	$12, 0$	$-1, -1$

c. List the ordered pair(s) (x, y) from above that are solutions to the compound sentence $x + y > 10$ and $y = 2x + 1$.

d. List three additional ordered pairs that are solutions to the compound sentence $x + y > 10$ and $y = 2x + 1$.

e. Sketch the solution set to the inequality $x + y > 10$ and the solution set to $y = 2x + 1$ on the same set of coordinate axes. Highlight the points that lie in BOTH solution sets.



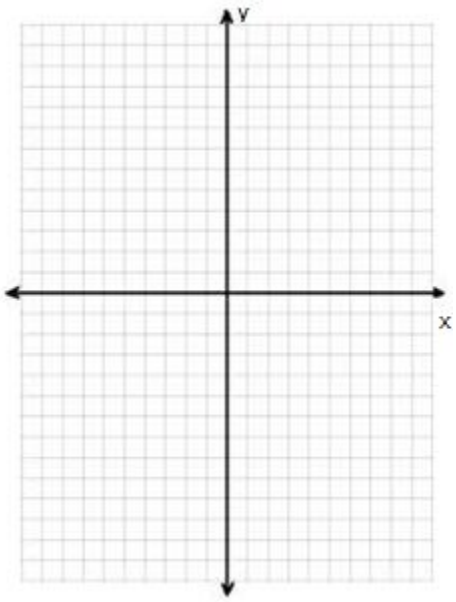
f. Describe the solution set to $x + y > 10$ and $y = 2x + 1$.

Example 1

Solve the following system of equations.

$$y = 2x + 1$$
$$x - y = 7$$

Graphically:

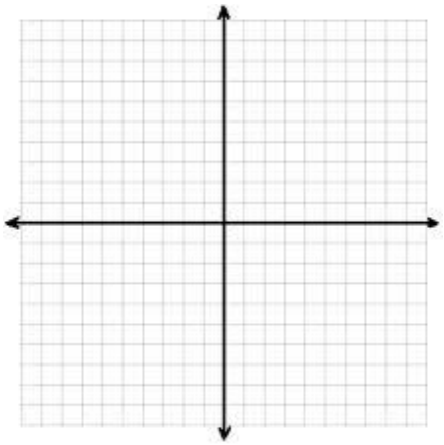


Algebraically:

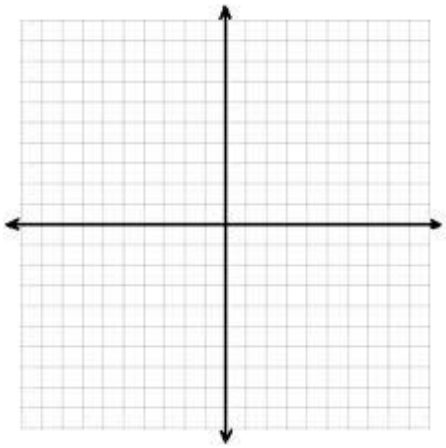
Exercise 1

Solve each system first by graphing and then algebraically.

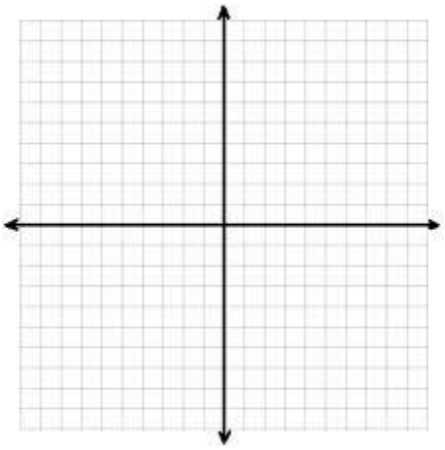
a. $y = 4x - 1$
$y = -\frac{1}{2}x + 8$



b. $2x + y = 4$
$2x + 3y = 9$



c. $3x + y = 5$
$3x + y = 8$

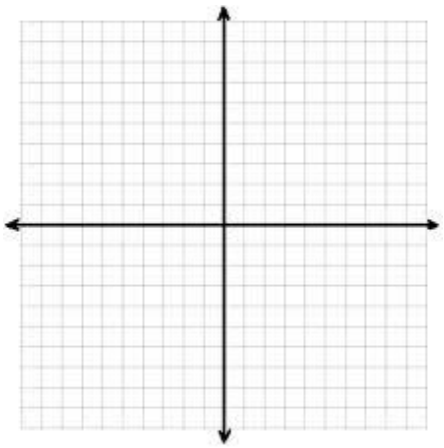


Example 2

Now suppose the system of equations from Exercise 1(c) was instead a system of inequalities:

$3x + y \geq 5$
$3x + y \leq 8$

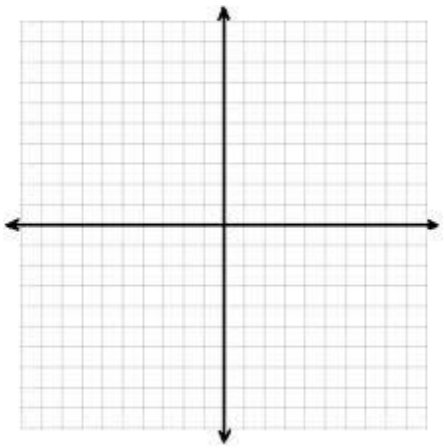
Graph the solution set.



Example 3

Graph the solution set to the system of inequalities.

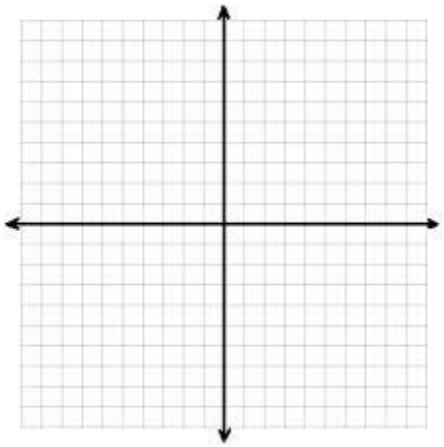
$$2x - y < 3 \text{ and } 4x + 3y \geq 0$$



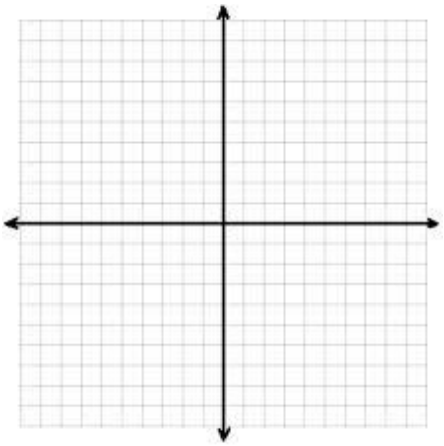
Exercise 2

Graph the solution set to each system of inequalities.

a. $x - y > 5$
$x > -1$



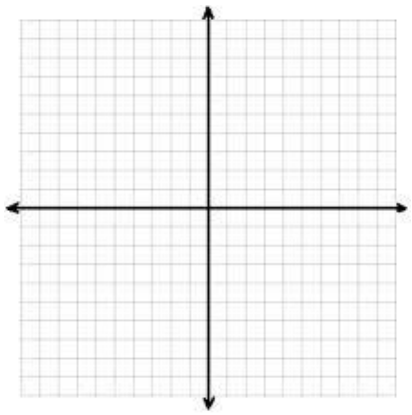
b. $y \leq x + 4$
$y \leq 4 - x$
$y \geq 0$



Problem Set

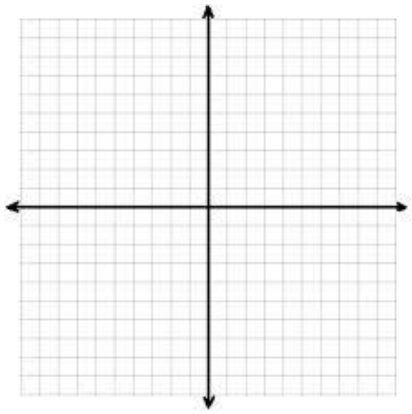
1. Solve the following system of equations first by graphing and then algebraically.

$$4x + y = -5$$
$$x + 4y = 12$$



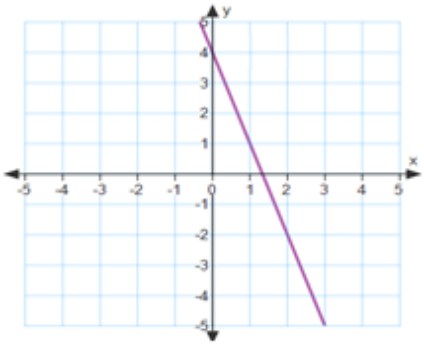
2.

a. Without graphing, construct a system of two linear equations where $(0, 5)$ is a solution to the first equation but is not a solution to the second equation, and $(3, 8)$ is a solution to the system.



b. Graph the system and label the graph to show that the system you created in part (a) satisfies the given conditions.

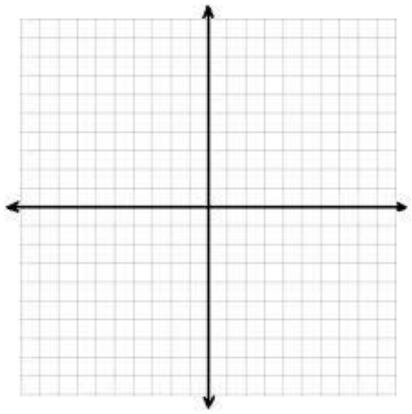
3. Consider two linear equations. The graph of the first equation is shown. A table of values satisfying the second equation is given. What is the solution to the system of the two equations?



x	-4	-2	0	2	4
y	-26	-18	-10	-2	6

4. Graph the solution to the following system of inequalities:

$$x \geq 0$$
$$y < 2$$
$$x + 3y > 0$$



$$x \geq 0$$
$$y < 2$$
$$x + 3y > 0$$

5. Write a system of inequalities that represents the shaded region of the graph shown.

6. For each question below, provide an explanation or an example to support your claim.
   a. Is it possible to have a system of equations that has no solution?
   b. Is it possible to have a system of equations that has more than one solution?
   c. Is it possible to have a system of inequalities that has no solution?